

Method & Statistics

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Outline

- ◆ Scientific Research
 - Different Steps
 - Different Approaches
 - Design
 - Setting
 - Data
 - Reliability & Validity
- ◆ After Data Collection
 - Null Hypothesis Testing
 - Statistics
 - Central Tendency
 - Variability
- ◆ Ethics

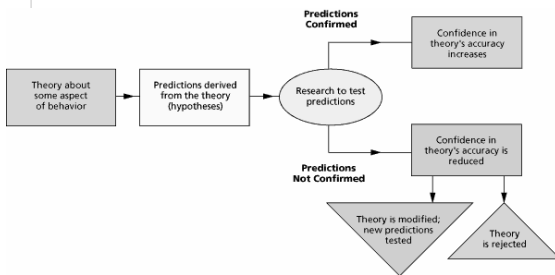
Definitions

- ◆ Hypotheses
 - Tentative explanation or prediction
- ◆ Theories
 - Frameworks for explaining events
 - Formal statements that explain how and why certain events are related
 - Theories are broader than hypotheses
- ◆ Variable
 - A factor in the world that you want to explore
 - Aggression, colour-blindness, attraction, learning...
 - Operational Definition
 - How you are specifically going to define your variable
 - Aggression → # of punches? # of verbal threats?

Steps in Scientific Research

- ◆ Initial observation/question
- ◆ Form hypothesis
- ◆ Test hypothesis
 - conduct research
- ◆ Analyze data
 - Do results support the hypothesis?
- ◆ Do further research and build a theory
 - Account for amassing data
 - Adjust theory on the basis of new findings

Scientific Research in Action...



Descriptive Design

- ◆ Surveys
 - The use of interviews and questionnaires in studying human behavior
- ◆ Types of Surveys
 - Telephone
 - Fast and efficient
 - Interviewer bias
 - Mail
 - Avoids interviewer bias
 - Response bias
 - Personal Interview
 - Flexibility
 - Costly and interviewer bias

Please tell us a little about your current relationship feelings

For each of the following pairs of opposite adjectives, select the circle that best describes HOW YOU FEEL ABOUT YOUR relationship. Base your responses on your first impressions and immediate feelings about the item.

- | | | | | | | | | | |
|--------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------|
| Interesting | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Boring |
| Bad | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Good |
| Unpleasant | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Pleasant |
| Full | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Empty |
| Weak | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Strong |
| Satisfied | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Dissatisfied |
| Lonely | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Friendly |
| Sturdy | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Fragile |
| Rewarding | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Disappointing |
| Discouraging | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Hopeful |
| Enjoyable | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Miserable |
| Tense | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Relaxed |
| Stable | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Unstable |
| Happy | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Sad |
| Stressful | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Peaceful |



◆ Naturalistic Observation

- Involves the careful observation and recording of behavior in real-life settings
 - e.g., watching children in daycare
- Behaviour is observed where it typically occurs
- Can't establish cause & effect
- Costly to run



◆ Case Study

- In-depth examination of one person
 - e.g., study the deficits or changes that occur to a person who suffers brain damage
- Enables intensive study of rare phenomena
- Generalizability of the findings is questionable
- Potential researcher bias

Correlational Design

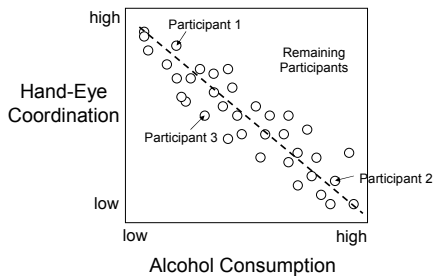
◆ Correlations

- Assess relationships between naturally occurring variables
 - ◆ You can measure two variables and then compute a correlation to see if there is a meaningful relationship

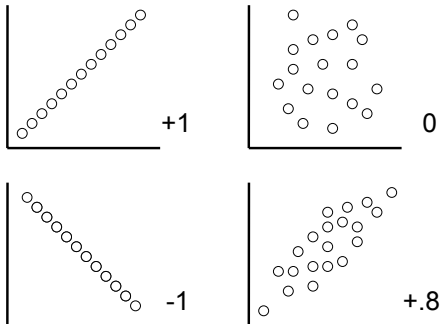
◆ Addresses questions such as

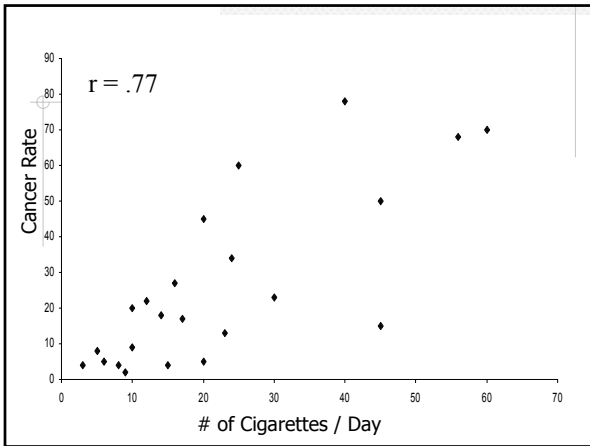
- How does one behaviour relate to the occurrence of another behaviour?
- By knowing one behaviour, can you predict the occurrence of another behaviour?

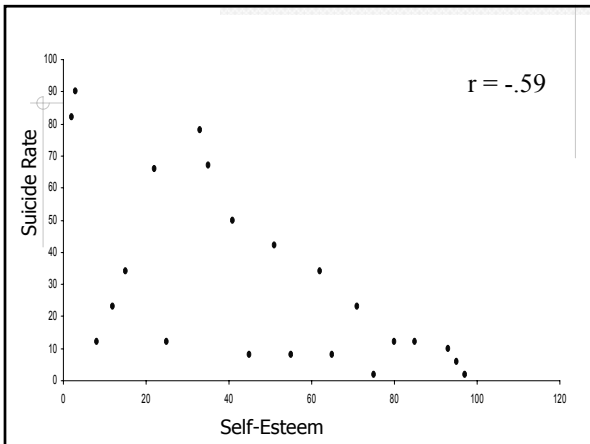
An Example

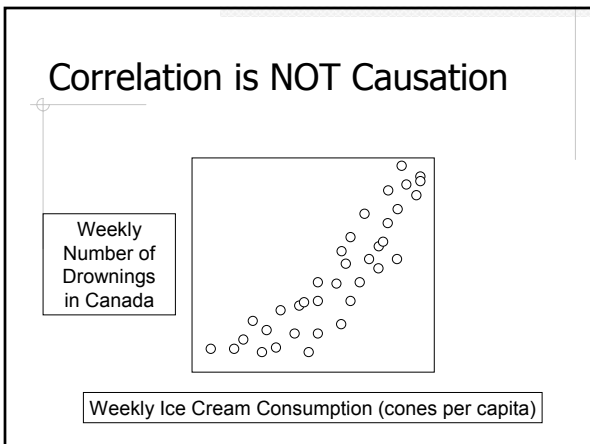


Correlation Coefficients









Beware of the Media!

98 ■ SATURDAY, SEPTEMBER 12, 1998

Smoking, drinking linked to divorces

WRITERS

WASHINGTON — Children of divorced parents are more likely to smoke and have drinking problems as adults than people whose families remained together, according to a study released yesterday.

The study found parental divorce increased the probability of smoking in adulthood by about one-third, and for boys, a single parent meant about a one-third greater chance of becoming a problem drinker.

Nicholas Wolinger, a sociologist at the University of Utah who led

the study, published his findings in the *Journal of Health and Social Behavior*. He examined nationwide data collected from 1977 to 1994 from interviews with more than 11,000 people ages 18 to 89.

He said the study indicated the habits lasted well into adulthood, posing a serious health risk.

"Now we know this is not a habit they will drift out of," he said. "It says divorce has lasting implications for the physiological well-being of children."

Because divorce affects not only

the mental well-being but the physical health of children, substance abuse education and prevention efforts should be reinforced, he said.

"Education campaigns should target children of divorce," he said.

But the study also showed remarriage could erase the effect of divorce on problem drinking — but not smoking — for boys. For girls, a new parent meant a slight decline in the number who smoked, although the figure remained higher than among women whose parents did not divorce.

Experimental Design

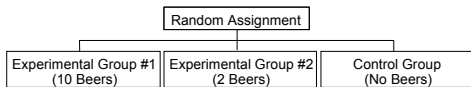
◆ Experiments

- Determine the cause-effect relationships between two or more variables
 - ◆ The researcher manipulates one variable
 - ◆ The researcher measures whether this variable produces changes in another variable
 - ◆ The researcher attempts to control for other factors that might influence the results

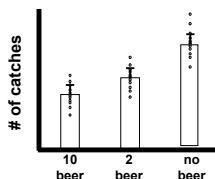
◆ Why do we care about cause and effect?

- Do treatments really work?

An Example



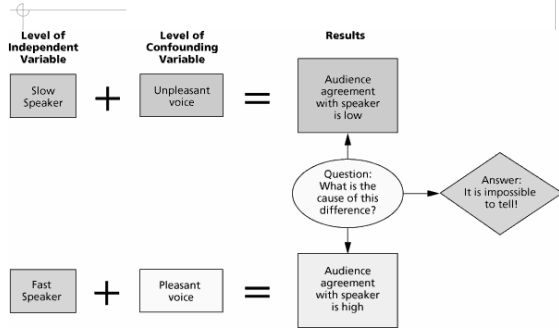
Then measure the dependent variable (e.g. hand-eye coordination) and calculate the mean for each group



◆ Good experiments have high

- Reliability
 - ◆ Stability & Consistency
- Internal Validity
 - ◆ The IV truly causes the changes in the DV
- External Validity
 - ◆ You can generalize your results
- Construct Validity
 - ◆ Your measure is truly tapping into the variable you want

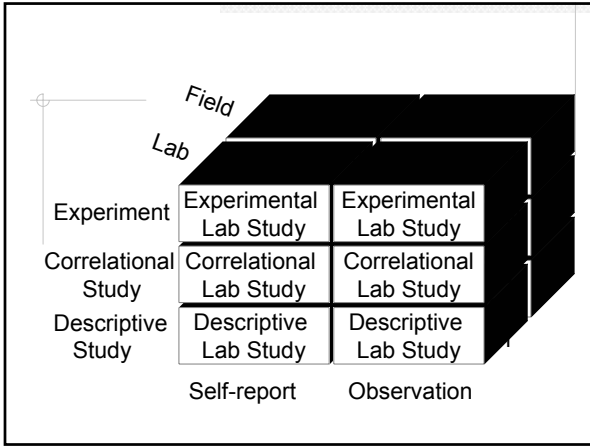
Confounds



Different Ways to Do Research



- ◆ Setting
 - Field Study
 - Lab
- ◆ Data
 - Self-Report
 - Observation
- ◆ Design
 - Descriptive
 - Correlational
 - Experimental



Examples...



◆ Subjects are randomly assigned to watch either a violent or a non-violent video and then are watched for aggression while playing with a large inflated Bobo doll in the lab

- Setting?
- Data?
- Design?



◆ The relation between birth order and the amount of aggression on the school playground is assessed during recess

- Setting?
- Data?
- Design?

◆ Children are interviewed in the lab regarding their opinions about aggression



◆ The relationship between body size and the frequency of aggressive acts is measured in male Ring-tailed lemurs in the forests of Madagascar

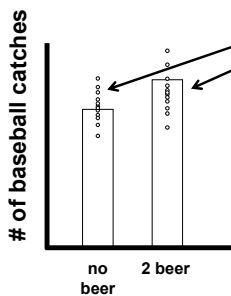
After Data Collection...

◆ Need to test our hypothesis

■ Null Hypothesis Testing

- ◆ Assume there are no differences between groups
 - All conditions are the same
- ◆ The groups won't all have the EXACT same #s
 - If there are no real differences, how much would they differ just by chance?
- ◆ We use statistics to determine what size of a difference is likely by chance
 - If the differences between our groups is larger than what we'd expect by chance → we reject the idea that our conditions are all the same
 - Conclude we have real group differences

Statistics



These two values are clearly different

BUT...
Is this difference meaningful?

How big are those differences compared to the variability in the data?

Looking at Data

8 11 6 7 5 9 5 9 9 11

Score Frequency

11 2

10 0

9 3

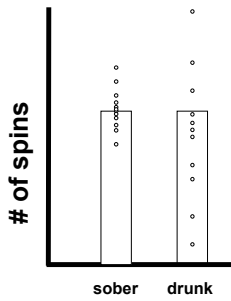
8 1

7 1

6 1

5 2

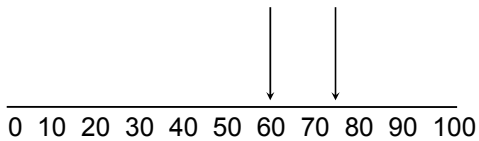
Variability



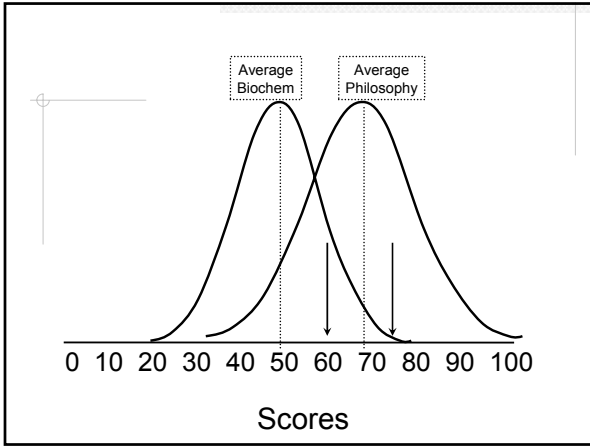
Application

Did you do better in Biochemistry or Philosophy?

Biochem mark: 60 Philosophy mark: 75



Scores



Standard Scores

$$Z = \frac{\text{Score} - \text{Mean}}{\text{Standard Deviation}}$$

Allows one to compare different distributions
Did you do better in Biochemistry or Philosophy?

Biochem mark: 60 Philosophy mark: 75
(Mean = 50, SD = 10) (Mean = 69, SD = 12)

$$Z = \frac{60 - 50}{10}$$

$$Z = \frac{75 - 69}{12}$$

$$Z = +1$$

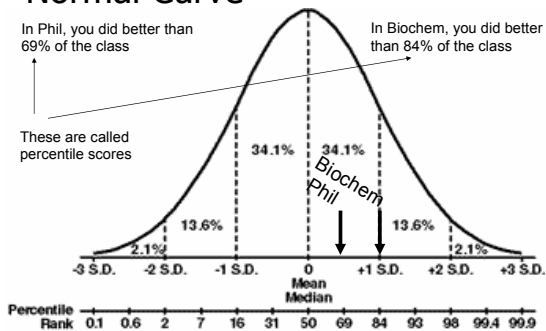
$$Z = +0.5$$

Normal Curve

In Phil, you did better than 69% of the class

In Biochem, you did better than 84% of the class

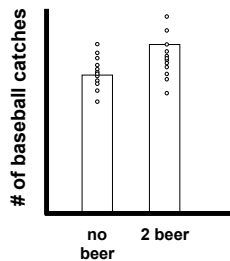
These are called percentile scores



Things that Influence Statistics

- ◆ The size of the difference between two measurements
 - Bigger difference → more significant
- ◆ The variability of the measurements
 - More variable data → less significant
- ◆ The number of measurements
 - More measurements → more significance

Back to our example...



So what happens?

Does alcohol affect hand-eye coordination?

Ethics

- ◆ Research with Humans
 - Informed Consent
 - Confidentiality & Anonymity
 - Deception & Debriefing
- ◆ Research with Animals
 - Only use animals when necessary
 - ◆ Only when data critical to helping humans
 - Maintain the health of animals in experiments and animal housing
 - ◆ Humane treatment is essential
