1. **Variables**
   - Psychology -- study of the relationship among variables
   - Types of variables
     - Situational variables
       - Characteristics of situation or environment
     - Response variables
       - Responses or behaviors of participant
     - Subject variables
       - Characteristics of the participant
     - Mediating variables
       - Psychological processes that alter or control the effect of situational variables on response variables

2. **Example of variable types**
   - Experiment -- effect of pupil dilation on likeability
   - Show faces of people
     - Some faces with large pupils
     - Some faces with small pupils
   - Get rating of “likeability” (1=low; 7 = high)
     - Compare likeability of “large” and “small” pupil faces
   - Also compare responses of female and male subjects
     - Do females and males show the same pattern?
   - Situational variable?
   - Response variable?
   - Subject variable?
   - Mediating variable?

3. ** Constructs**
   - Hypothetical factor used in the explanation of other phenomenon
   - Can’t observe or measure directly – but we assume they exist
   - Examples:
     - likeability, love, hunger, intelligence, ambition, scholastic aptitude, political conservatism, spatial imagery, aggression, fear
   - Use in our theories and explanations
   - In order to study – we need to define constructs in some way...

4. **Operational Definitions**
   - Definition of a concept or construct in terms of procedures used to produce and/or measure it
   - Need to operationally define manipulations
     - Ex: pupil size
   - Need to operationally define measurements
     - Ex: likeability
   - Benefits:
     - allows for precision
     - provides a method for quantification
     - reduces ambiguity
     - others know exactly what you are talking about
     - may disagree with op def, but won’t be confused or misunderstood

5. **Operational Definitions: Exercise**
   - Increased frustration leads to increased aggression
   - Generate Operational Definitions for:
     - Frustration
     - Aggression
Converging Operations
- If . . .
  - there is a general construct such as frustration
  - and
  - there is a general construct such as aggression
- should be able to measure or tap into each construct in several different ways
- should be able to operationally define in different ways
- Converging operations -- coming at problem from many different angles -- reaching the same general conclusion

Experimental & Nonexperimental Methods
- Different ways to determine if variables are related
- Nonexperimental Research
  - Measurement/Observation of variables as they naturally occur
  - Little or no control over actual variables of interest
- Experimental Research
  - Direct manipulation and control of variables
  - Manipulate variable of interest -- observe effect on other variable(s)
  - Typically
    - manipulate situational variable (IV)
    - Observe effect on response variable (DV)

Exercise
- Categorize frustration-aggression research
  - Experimental
  - Nonexperimental

Relationships among variables
- Different possible patterns
  - Pos Linear
  - Neg Linear
  - Curvilinear
  - No relationship

Positive Relationship
- Example: Time spend studying -- grade on exam

Negative Relationship
- Example: Number of absences -- grade on exam

Curvilinear Relationship
- Example: amount of caffeine -- performance on attention task

No Relationship
- Example: Number of siblings -- grade on exam

Correlational vs. Experimental Research
- Correlational (Nonexperimental)
  - Measure variables as they naturally occur
  - Ex: study time and grade
    - Measure reported study time
    - Measure grade
• Examine relationship
  ▪ Experimental
    – Manipulate one variable – measure effect on other variable
    – Ex: study time and grade
  ▪ Manipulate study time (different conditions)
  ▪ Measure grade
  ▪ Examine relationship

15 □ Correlation
  ▪ Correlation – covariation among variables
  ▪ As one variable changes – trend for other variable to change
  ▪ Can see relationship using scatterplot
    – Direction of the relationship
    ▪ Positive or negative
    ▪ Strength of relationship
    ▪ Strong or weak

16 □ Scatterplot
  ▪ Example: Time spend studying – grade on exam
    – Strong positive relationship

17 □ Scatterplot
  ▪ Example: Number of absences – grade on exam
    – Weak negative relationship

18 □ Correlation Coefficients
  ▪ Pearson Product Moment Correlation Coefficient
    – Pearson’s r
    – Measures linear relationship
    – Range of possible values:
      ▪ -1.0 to 1.0
      ▪ Sign – direction of relationship
        ▪ Negative or positive
      ▪ Absolute value – strength of relationship
        ▪ 0 – no relationship
        ▪ 1.00 – perfect linear relationship

19 □ Correlational Research and Causality
  ▪ Establishing causal relationship
    – Covariation (yes)
    – Time order (maybe)
    – Elimination of plausible alternative explanations (no)
  ▪ Third variable problem
    – May see a correlation between two variables
      ▪ Due to both being related to a third variable
    – Ex: Correlation between ice cream sales and violent crime
    – Ex: Correlation between stork population and birth rate in Germany
    – Ex: Condom use and alcohol consumption

20 □ Other issues
  ▪ Curvilinear relationships
    – Pearson r – linear relationships
  ▪ Restricted range

21 □ Multiple Correlation
Correlation – predict one variable from another variable
- Multiple correlation – use multiple predictors
  - Gives better prediction

Partial Correlation
- Statistical technique for dealing with third variable problem
- Statistically “control for” or take out correlation due to third variable
- “Partialed Out”
- Ex: Correlation between violent media consumption and speed to identify angry/happy faces
- Related to sex?
  - Examine by “partialing out” sex as a factor
  - See if correlation still exists.

Experimental Basics
- Manipulate one variable
  - Independent Variable (IV)
- Measure effect on another variable
  - Dependent Variable (DV)
- Hold everything else constant
  - Control Variables
- If DV changes -- had to be caused by changes in IV

Example
- Pupil dilation and likeability
- Two sets of pictures
  - One set -- large pupils
  - Other set -- small pupils
  - Identical in every other way
    - Same people, same facial expressions, same lighting, same clothing, etc.
- If likeability ratings differ -- had to be caused by changes/differences in pupil size

Necessary Conditions for Causal Inference
- A well designed experiment meets these criteria:
  - Time order / precedence
    - Assume that ratings would be the same prior to manipulation of pupil size
  - Covariation
    - Changes in pupil size accompanied by changes in likeability ratings
  - Elimination of plausible alternative explanations
    - If everything else held constant
    - No confounding variables (later)
    - No other cause for a change in DV

Three Types of Validity
- Evaluation of a research study
- Different criteria – Types of validity:
  - Construct validity
  - Internal validity
  - External validity

Construct Validity
- Do operational definitions used reflect constructs under study?
  - Manipulation of constructs
– Measurement of constructs

• Ways to establish
  – Manipulation checks
  – Validity of measures
  – Converging operations

28 Internal Validity

• Ability to make causal inference from data
  – Type of design
  – Presence of confounds (alternative explanations)

29 External Validity

• Ability to generalize results beyond specific population or situation studied
• Robustness of finding
  – Obtains with different population
  – Different setting
  – Different operational definitions

30 Research Example


• Multiple Methods
  – Multiple Goals
  – Different Strengths & Weaknesses

• Noted: Color black often associated with “Bad or Evil”
  – Death, Darth Vader, Cowboys, etc.
• Asked: Can someone’s clothes color influence behavior
  – Can wearing black make someone more aggressive?

31 F&G Study 1

• Had “sports naïve” subjects view uniforms (NFL & NHL)
• Judgments on Semantic Rating Scale
  – Bad ~~~~~~~~~~~~ Good
  – Aggressive ~~~~~~ Passive
  – Nice ~~~~~~~~~~~~ Mean

• Aggregate measure of “badness”
• Black uniforms – rated as more bad than non-black uniforms

32 F&G Study 2

• If black uniforms lead to aggression – correlation between black uniforms and aggressive acts
• Used NFL and NHL Records
• Op Def of aggressive acts – penalties
  – penalty yards (NFL)
  – penalty minutes (NHL)
• measured the penalties for black-clad vs. nonblack-clad teams

• Results
  – found correlation between uniform color and penalties
  – Black clad teams – higher than average penalties

33 Interpretation?
Possible explanations for correlation?
- Wearing black makes people more aggressive
- Officials perceive people wearing black as more aggressive
- Teams wear black because they want a “tough” image -- seek out “mean” players

Correlation does not imply causation
Necessary conditions for Causal Inference?

34 Team identity hypothesis
- Tested by examining penalties for two teams that changed uniform colors (one in mid year)
  - (archival research)
- Pittsburgh Penguins and LA Kings
- Little player turnover
- Both teams showed dramatic increase in penalties immediately after switch
- Discounts team identity hypothesis

Leaves:
- Black makes players more aggressive
- Black perceived as more aggressive

35 F&G Study 3
- Ran experiment to test perception hypothesis
- Filmed a staged football play -- Tackle
- Two conditions:
  - Defense in white
  - Defense in black
- Ratings of:
  - Aggressiveness
  - Likelihood of penalty
- Both college students and college football officials
  - Judged black defense as more aggressive
  - Judged as more likely to receive penalty
- Supports perception hypothesis

36 F&G Study 4
- Aggression Induction hypothesis
- Experiment -- brought college students into a laboratory
  - Two groups of three
- Given choice of 12 games to play (ranged in aggressiveness)
- Games assigned aggressiveness rating of 1-12
- Each subject chose 5 games when they first entered lab
  - Op De of Aggression: total aggressiveness score for games
- Subjects assigned to teams of 3 -- donned white or black jersey to foster “team”
- Subjects then chose 5 games as a team

37 Results:

Aggressiveness Ratings (higher score = more aggressive)

<table>
<thead>
<tr>
<th></th>
<th>w/out jersey</th>
<th>w/ jersey</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>113.4</td>
<td>115.8</td>
</tr>
<tr>
<td>Black</td>
<td>113.5</td>
<td>130.3</td>
</tr>
</tbody>
</table>
- Supports Aggression Induction hypothesis
- Both factors contribute to correlation between uniform color and penalties