Looking for laws

- Psychologists share these three goals with scientists:
  - Measurement and description
  - Understanding and prediction
  - Application and control
Looking for laws

- **Hypothesis** – a tentative statement about the relationship between two or more variables
  I think that when high school AP students are placed under extreme pressure they work harder.

- **Variables** – any measurable conditions, events, characteristics, or behaviors that are controlled or observed in a study
  AP student course grades

- **Theories** – a system of interrelated ideas used to explain a set of observations
  - Theories must be testable
  - Theories allow psychologists to move from description to understanding behavior
Scientific approach

Two major advantages to using it:

1. Clarity and precision – researchers define exactly what they are talking about (operational definitions)
2. Relative intolerance of error – scientists scrutinize and apply a critical eye to studies, the data, and conclusions – they maintain objectivity

The scientific approach offers various approaches to the observation, measurement, manipulation, and control of variables in empirical studies.
Steps in a scientific investigation

1. Formulate a testable hypothesis
2. Select the research method and design the study
3. Collect the data
4. Analyze the data and draw conclusions
5. Report the findings
Step 1: Formulate a testable hypothesis

- Scientific hypotheses must be formulated precisely
- The variables under study must be clearly defined
- **Operational definition** – describes the actions or operations that will be used to measure or control a variable
  - define what is meant in the context of the study
Step 2: Select the research method and design the study

• How to put the hypothesis to an empirical test

• Various methodologies to choose from: experiments, case studies, surveys, naturalistic observation, etc.
  • The researcher must determine the best method for their study as all have pros and cons

• After determining method, must carefully design the study
Step 3: Collect the data

• Researchers must then collect the data

• Data collection techniques are procedures for making empirical observations and measurements
  • Include direct observation, questionnaires, interviews, psychological tests, physiological recordings, examination of archival records, etc.
  • The technique will depend upon what is being studied

• Collecting data can sometimes take a long time (months or even years)
Step 4: Analyze the data and draw conclusions

- Observations are usually converted into numbers then statistics are used to analyze and make sense of the data.
- From the statistical analysis the researcher can determine if the hypothesis was correct.
Step 5: Report the findings

- The publication of the research is essential to science to share results
- The findings are typically published in academic journals
- A journal is a periodical that publishes technical and scholarly material, usually in a narrowly defined area of inquiry
  - Allows other experts to review the study and its findings
  - Peer review – the process by which other experts in the field critique a study prior to publication to determine its strengths, weaknesses, significance, and contribution to the field
The components of an experiment

• The experiment is a research method in which the investigator manipulates a variable under carefully controlled conditions and observes whether any changes occur in a second variable as a result.

• Parts of an experiment
  • Independent variables (IV)
  • Dependent variables (DV)
  • Experimental and control groups
  • Extraneous variables
Independent and dependent variables

How does X affect Y?

- **Independent variable** – a condition or event that an experimenter varies in order to see its impact on another variable
  - This is the variable controlled by the experimenter
  - It is hypothesized to have an effect on the dependent variable
  - *Independent* because it is *free* to be manipulated by the experimenter

- **Dependent variable** – the variable that is thought to be affected by manipulation of the independent variable
  - Typically, a measurement of some aspect of the participant’s behavior
  - *Dependent* because it is thought to *depend* on the manipulation of the independent variable
A researcher is interested in how heart rate and blood pressure are affected by viewing a violent film sequence as opposed to a nonviolent film sequence.

**Independent variable:** Film sequence (scary or not)

**Dependent variable:** Heart rate
An organizational psychologist develops a new training program to improve clerks’ courtesy to customers in a large chain of retail stores. She conducts an experiment to see whether the training program leads to a reduction in the number of customer complaints.

Independent variable: New training program
Dependent variable: Customer complaints
A researcher wants to find out how stimulus complexity and stimulus contrast (light/dark variation) affect infants’ attention to stimuli. He manipulates stimulus complexity and stimulus contrast and measures how long infants stare at various stimuli.

**Independent variable:**
- Stimulus complexity
- AND
- Stimulus contrast

**Dependent variable:**
- Length of time infants stare/attention to stimuli

Can you see a potential issue with this study?
A social psychologist investigates the impact of group size on a subjects’ conformity in response to group pressure.

Independent variable: Group size
Dependent variable: Conformity level
Experimental and Control Groups

- The **experimental group** consists of the subjects who receive some special treatment in regard to the independent variable.

- The **control group** consists of similar subjects who *do not* receive the special treatment given to the experimental group.

- The idea is that the independent variable will affect the behavior of the experimental group that is observable against the unchanged behavior of the control group.

- The groups can never be exactly the same but controlling the variables affecting them creates enough commonality to compare them.
Extraneous variables

- Experimental and control groups have to be alike only on dimensions relevant to the dependent variables.

- **Extraneous variables** are any variables other than the independent variable that seem likely to influence the dependent variable in a specific study.
  - Another way to think of them is that they are variables that influence the outcome of an experiment, though they are not the variables that are actually of interest.
  - Researchers try to limit these as much as possible.

- **Confounding of variables** – when two variables are linked together in a way that makes it difficult to sort out their specific effects.
  - The researcher is unable to determine which variable acted upon the dependent variable
Variations in designing experiments

Many experiments manipulate multiple variables, not just one. Here are some variations some researchers use:

1. It is sometimes advantageous to use only one group of subjects who serve as their own control group. The effects on the IV are determined by exposing the control group to two different conditions – an experimental and a control.

2. It is possible to manipulate more than one IV in a single experiment.

3. It is possible to use more than one dependent variable in a single study.
Types of research methods

• Experimental
• Naturalistic observation
• Case studies
• Surveys
• Descriptive/Correlational research
Experimental research

The researcher manipulates one or more IVs to see the effect on one or more DVs.

**Advantages**

- Permits conclusions about cause-and-effect relationships between variables
- Allows researcher to isolate variables
- Allows research to neutralize the effects of extraneous variables

**Disadvantages**

- Experiments are artificial
- Cannot be used to explore some research questions (ethical concerns or practical realities)
- Manipulating variables may be impossible/impractical
Naturalist observations

A researcher engages in careful observation of behavior without intervening directly with the subjects.

**Advantages**

- Behavior occurs in natural environment
- Good starting point when little is known about the behavior
- Can be used to study animal behavior

**Disadvantages**

- Hard to be completely invisible – can change subject’s behavior (*reactivity*)
- Difficult to translate observations into numerical data
- Cannot draw causal conclusions
### Case studies

An in-depth investigation of an individual subject. Various techniques such as interviews with the subject and friends, direct observation, examination of records, and psychological testing may be employed. If the subject committed suicide or is deceased, it’s called a *psychological autopsy*.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
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<tr>
<td>• Well suited for studying the roots of psychological disorders and the efficacy of therapeutic practices</td>
<td>• Highly subjective</td>
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<td>• Can provide real-life illustrations supporting theories or hypotheses</td>
<td>• Typically unrepresentative of the general population</td>
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Surveys

Researchers use questionnaires or interviews to gather information about specific aspects of participants’ background, attitudes, beliefs, or behavior.

**Advantages**

- Can get information that is difficult to observe
- Easy to collect data on attitudes and opinions from large groups

**Disadvantages**

- Relies upon participation
- Researchers unable to draw causal conclusions
- Relies upon *self-reported data*
Descriptive/Correlational research

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Research method self-check

What’s the best research method for each of the following questions?

1. Are people’s attitudes about nuclear disarmament related to their social class or education? **Survey**
2. Do people who suffer from anxiety disorders share similar early childhood experiences? **Case Study**
3. Do troops of baboons display territoriality – that is, do they mark off their own and defend it from intrusion by other baboons? **Naturalistic Observation**
4. Can the presence of food-related cues (delicious-looking desserts in advertisements, for example) cause an increase in the amount of food that people eat? **Experiment**
Descriptive statistics

• Used to organize and summarize data

• Types:
  • Central tendency
  • Variability
  • Correlation
Central tendency

- Median – the score that falls exactly in the center of a distribution of scores
- Mean – the arithmetic average of the scores in a distribution
- Mode – the most frequent score in a distribution

| 10 | 4 |
| 9  | 4 |
| 7  | 3 |
| 7  | 3 |
| 5  | 2 |
| 5  | 1 |
| 5  | 1 |

What’s the median of this data set? 5
What’s the mean of this data set? 4.7
What’s the mode of this data set? 5
Beware outliers that can cause issues

20,000  Mode
20,000
25,000  Median
35,000
200,000

Mean = 300,000 / 5 = 60,000
Variability

- Refers to how much the scores in a data set vary from each other and from the mean.

- **Standard deviation** – an index of the amount of variability in a set of data


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Correlation

- Exists when two variables are related to each other
- The correlation coefficient is a numerical index of the degree of relationship between two variables. It indicates:
  1. the direction (positive or negative) of the relationship
  2. how strongly the two variables are related

- A **positive correlation** indicates that the two variables co-vary (move) in the same direction.

- A **negative correlation** indicates that the two variables co-vary (move) in the opposite direction.
Positive correlation

If a correlation is positive, a plus sign (+) may precede it.
Negative correlation

If a correlation is negative, a negative sign (-) will precede it.
Strength of a correlation

The closer to 1, the stronger the correlation.
Correlations

- Correlation and prediction
  - The stronger the correlation (the closer to 1 either positive or negative) is, the greater the ability to predict how the IV will influence the DV.

- Correlation and causation
  - Highly correlated variables do not necessarily mean causation (foot size and vocabulary)
  - We can only conclude that X and Y are related

Correlation does not equal causation!
Concept check

Researchers have found substantial positive correlation between youngsters’ self-esteem and their academic achievement (measure by grades in school). Which of the following conclusions are based on this correlation?

A. Low grades cause low-esteem.
B. There is an association between self-esteem and academic achievement.
C. High self-esteem causes high academic achievement.
D. High ability causes both high self-esteem and high academic achievement.
E. Youngsters who score low in self-esteem tend to get low grades, and those who score high in self-esteem tend to get high grades.
Concept check

Indicate whether you would expect the following correlations to be positive or negative.

A. The correlation between age and visual acuity among adults.
B. The correlation between years of education and income.
C. The correlation between shyness and the number of friends one has.
D. The correlation between class attendance and class grade.
Inferential statistics

• Does a researcher’s data support his or her hypothesis?
• Inferential statistics are used to interpret data and draw conclusions.

• Statistical significance
  • Exists when the probability that the observed findings are due to chance is very low.
  • Significant when there’s less than 5 chances in 100 that the results were due to chance
    • Referred to as .05 level of significance
  • Calculated by considering the variability in the data
Evaluating research – looking for flaws

- **Replication** – the repetition of a study to see whether the earlier results are duplicated.

- **Meta-analysis** – combines the statistical results of many studies of the same question, yielding an estimate of the size and consistency of a variable’s effects.
  - Studies may have been performed using different methods
Evaluating research – looking for flaws

Sampling bias

- A sample is the collection of subjects for observation in an empirical study.
- The population is the much larger collection of animals or people (from which the sample is drawn) that researchers want to generalize about.
- Sampling bias exists when a sample is not representative of the population from which it was drawn.
Evaluating research – looking for flaws

• **Placebo effect** - occurs when participants’ expectations lead them to experience some change even though they receive empty, fake, or ineffectual treatment.

• **Social desirability bias** – a tendency to give socially approved answers to questions about oneself.

• Response set – a tendency to respond to questions in a particular way that is unrelated to the content of the questions.

• **Halo effect** – occurs when one’s overall evaluation of a person, object, or institution spills over to influence more specific ratings.
Experimenter bias

- Occurs when a researcher’s expectations or preferences about the outcome of a study influence the results obtained.

- Double-blind procedure – a research strategy in which neither participants nor experimenters know which subjects are in the experimental or control groups.
Ethics in research

• Does the ends justify the means?
• When is deception okay?
• The question of animal research

• APA ethical guidelines:
  1. Participation should always be voluntary
  2. Participants should not be subjected to harm or danger
  3. If deception is involved, participants should be notified as soon as possible
  4. Participants’ right to privacy should never be compromised

• With animals, harmful or painful experiments cannot be justified unless the potential benefits are substantial and research animals are entitled to decent living conditions