Research Basics

- Scientific Hypotheses: Factual statements that can be objectively evaluated.
- Which of the following is not a scientific hypothesis?
  - Women in this class are taller than men.
  - People who have high IQs have larger brains.
  - The world is flat.
  - My cats believe that I am God.

Just a theory???

- Layperson's definition of "theory": A guess
- Definition of a scientific theory: A set of statements of principles devised to explain a set of observed facts (i.e., supported hypotheses). Also used to make novel future predictions (i.e., as of yet untested hypotheses).
- A primary goal of science is to explain phenomena. A theory is an explanation based upon a collection of observed facts.
  - Primary goal of science is to develop new theories and test existing theories with new observations.

Just a theory???

- Can a theory (or hypothesis) ever be proven correct?
  - No. There will always be alternative explanations of things. Rather than deal with certainties, scientists base their beliefs on what is the most reasonable explanation.
  - Can you really prove anything?
- Good Theories: (1) explain a large number of prior observations, (2) survive repeated future tests using new observations, and (3) provide the most plausible explanation relative to other competing scientific theories.

Rules to follow for good science

- Study what you're interested in
  - Research can be a long and tedious process, full of rejection. Work weeks can be 80 hours or more. Pay is not good. You better love what you're studying.
- Do not have faith in your ideas
  - The world's great scientists used to think that the Earth was flat and the center of the universe. Nobody is above being wrong. Do not get offended because someone else thinks you're wrong about something. Be willing to consider that 100 years from now people will think of your most cherished beliefs as witchcraft.
- Be critical of what you hear/read
  - Science is "self-correcting" and only works if people question what they read. The most exciting research is that which contradicts fundamental beliefs.

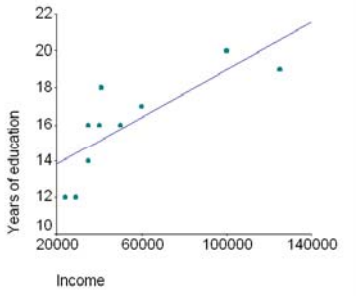
Basic types of research

- Correlational studies
- General hypothesis:
  - X <-> Y, X is related to Y in some way.
- Specific hypothesis:
  - X is positively related to Y
  - X is negatively related to Y
  - X is unrelated to Y

Correlation

- X is positively related (correlated) to Y
- As X goes up, so to does Y
- A X goes down, so to does Y
  - X and Y "move" in same direction.

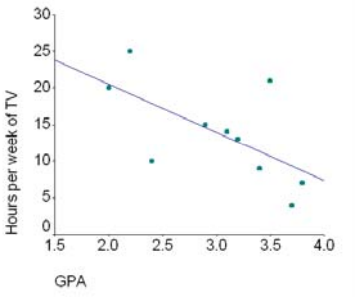
Participant	Income	Years of Education
#1	125,000	19
#2	100,000	20
#3	40,000	16
#4	35,000	16
#5	41,000	18
#6	29,000	12
#7	35,000	14
#8	24,000	12
#9	50,000	16
#10	60,000	17



Correlation

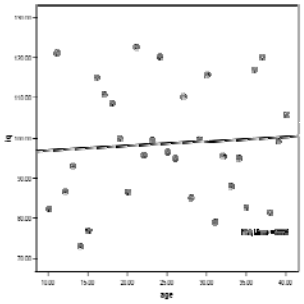
- X is negatively related (correlated) to Y
- As X goes up, Y goes down
- A X goes down, Y goes up
  - X and Y "move" in the opposite direction.

Participant	GPA	TV in hours per week
#1	3.1	14
#2	2.4	10
#3	2.0	20
#4	3.8	7
#5	2.2	25
#6	3.4	9
#7	2.9	15
#8	3.2	13
#9	3.7	4
#10	3.5	21



Correlation

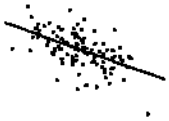
- X is unrelated (uncorrelated) to Y
- As X goes up, Y does something random
- A X goes down, Y does something random
  - X and Y "move" randomly relative to one another.
  - You cannot predict Y based on X or X based on Y.



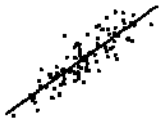
Correlation coefficient

- Just a number that represents the direction (positive or negative) and the strength of the relationship between X and Y (e.g., r = .78).
- Ranges from -1.00 to +1.00
- Negative values (e.g., r = -.21) represent negative relations; positive values (e.g., r = +.34) represent positive relations.
- The size of the value—from 0.00 to 1.00 (don't think about whether it's positive or negative)—represents how strong the relation between X and Y.
- 0.00 = no relation (if all you know is X, then you can only give a random guess about what Y will be)
- 1.00 = perfect relation (if all you know is X, you can perfectly predict Y)
- *Almost all coefficients are greater than 0.00 and less than 1.00.*

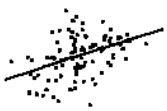
r = +1.00



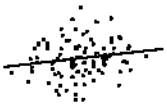
r = -.54



r = +.85



r = +.42

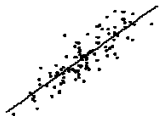


r = +.17

- Coefficients are useful because it is difficult to estimate the strength of correlations just by looking at graphs.

Meaning of a correlational result

- Say you ask a group of 100 people how many hours of violent videogames they play per week and then you give them a measure of aggression.
- Results look like this:
  - Hours of violent VG playing is correlated with aggression at +.85.
- What are the possible interpretations of this result?



Possible interpretation

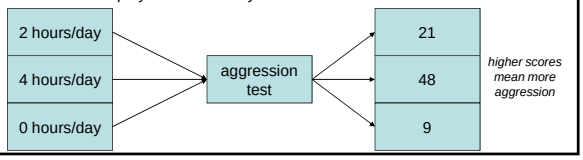
- X causes Y (violent video game playing causes people to be more aggressive)
  - Standard and perhaps most intuitive explanation
- Y causes X (being more aggressive causes people to play violent video games more often)
  - Less intuitive, but equally probable (Do people who are romantics at heart watch more romantic movies? Do romantic movies make people more romantic?)
- X and Y are both caused by Z (e.g., Testosterone causes aggression and predisposes people to play violent video games. Men have higher testosterone than women. The link between video game violence and aggression is really a gender difference.)
  - Another plausible interpretation
- We really can't rule out any of these interpretations. Thus CORRELATION DOES NOT PROVE CAUSATION!
  - Correlation is necessary, but not sufficient for causation (i.e., for X to cause Y, X and Y must be correlated, but that is not enough).

How to show causation

- Experimentation
- Hypothesis: X -> Y, X causes Y
- X = Independent variable
  - The influence of X on Y is independent of other variables (e.g., Z).
- Y = Dependent variable
  - Changes in Y are dependent upon changes in X.

Experimentation

- Correlational study: X and Y are both measured.
  - e.g., Measure hours of video game play (X) and aggression level (Y)
- Experimental study: Y is measured, X is manipulated.
  - e.g., Measure aggression level (Y) and manipulate video game play
- Manipulation: Make a change to level of X
  - e.g., Make some people play video games for 2 hours/day for a month, and others play for 4 hours/day.



Experimentation

- How do you make sure that the influence of X on Y is independent of other variables?
- Randomly assign people to one level of X or the other (note that you can have more that 2 levels of X).
  - e.g., by flip-of-coin make ½ of sample play video games for 1 hour/day and the other half for 2 hours/day.
- Random assignment makes it so people in different levels of X are equivalent (on average) in terms of ALL characteristics (note that we're assigning people, not individual traits, thus everything that goes along with being a person is balanced).
  - e.g., Proper random assignment will make it so there is an equal number of men and women in each level of X. Therefore, gender can be ruled out as a possible explanation for relation between X and Y.

Confounds

- Confounds exist when changing X causes some other variable (Z) to change, which is the true cause of the change in Y.
- Results of study: people randomly assigned to play a violent videogame for 8 hours in the lab were significantly more aggressive than people assigned to play a violent videogame for 30 minutes.
- Possible confound?
  - How would you feel if someone made you sit in the lab for 8 hours playing the same videogame?
  - Might you be a little aggressive?
  - Would it really matter what you were doing in this study?
  - Being forced to do just about anything for 8 hours is going to piss most people off.
  - Possible confound: irritation, boredom probably a better explanation for this result that the violent videogame itself.

Demand characteristics

- When participants in studies know what is expected of them (they feel the demands of the study).
- Is participant behavior caused by (or even related to) X or by their knowledge of how you expect them to behave?
- e.g., You play a violent videogame for an hour, then asked how much you feel like hurting someone.
  - Pretty obvious what's expected from you in this study, eh?
  - Depending on your disposition, you may "cooperate" and report that you want to hurt someone, get annoyed that the experimenter is trying to control you and report just the opposite, or respond genuinely.
  - Point is that we have no idea which of these options is correct. Study is not very informative...
- Levels of deception and secrecy are often needed to combat demands characteristics.