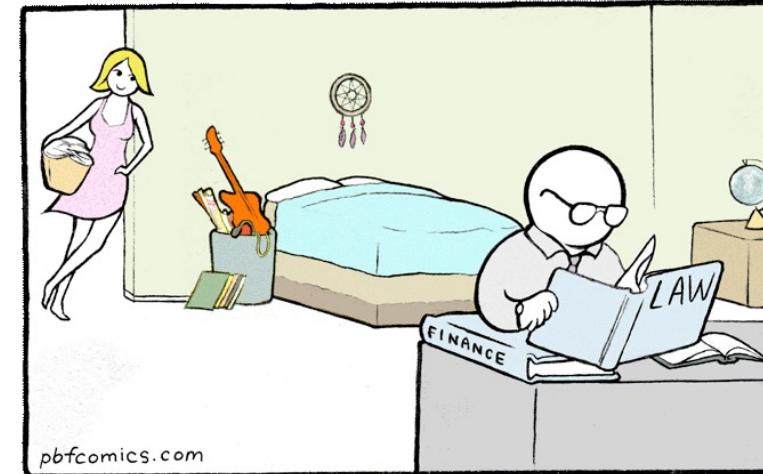


PSYC304:

Research methods

Jay Hosking, PhD



- Other methods of acquiring knowledge
- The scientific method
- Research design
- “Statistics”
- Validity



Outline

1. Why is authority considered the weakest form of knowledge? When is authority useful?
2. Why should you not rely solely on your intuition? Describe some errors using this form of knowledge.
3. Describe what science is, and the scientific method.
4. What features does good science require?
5. What features does pseudoscience typically have?
6. What are the goals of psychological research?
7. Be sure you can describe all types of variables in this lecture.
8. Define non-experimental and experimental studies. Why would you ever want to perform a non-experiment?
9. Understand the very basics of statistics in psychology.
10. What is P hacking? Why is it a problem?
11. Describe construct validity, how construct validity is attained, and internal/external validity.
12. What's the difference between accuracy and reliability? Be sure you could explain an example that would help anyone understand this difference.
13. Describe why we can't say that "IQ is 50% genetic."



Learning objectives

Why study research methods?

- For your health
- For your wallet
- For your career
- For your edification
- For your community
- *To properly understand and interpret psychology and neuroscience studies*



The central problem: How do we acquire correct information about the world?

i.e. “truth”, “facts”, “knowledge”

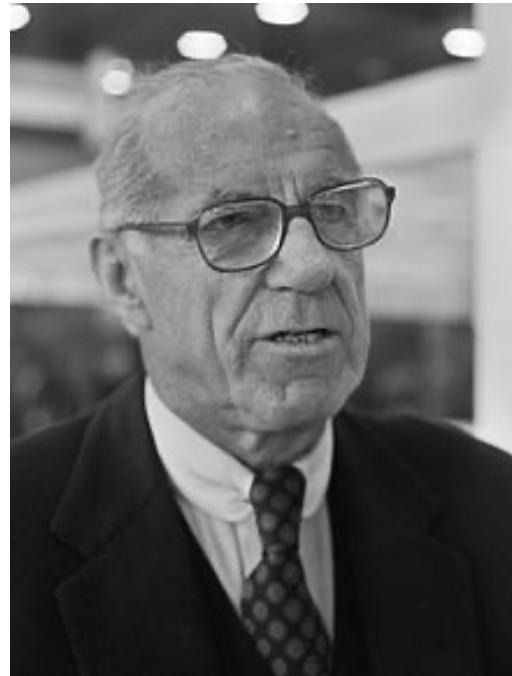
We can

- Ask someone else
- Trust our “guts”
- Observe
- Test



1. Authority

- Whose authority?
- Weakest form
- Sometimes useful
- When is it useful?
- Often exploited
- Often overextended



THE NEW YORK TIMES MEDICAL SCIENCE SECTION AUGUST 10, 1993

L C3

Sleeping Face Down Seems to Put Babies At Risk, Studies Say

By ROBERTSON B. ALTMAN
Scientists, doctors, parents and others are worried about the recent findings that babies who sleep face down in cribs have a higher risk of sudden infant death syndrome than those who sleep on their backs. The new evidence has led some to advise parents to change their babies' sleeping positions, while others say there is no proof that face-down sleepers are at greater risk.

But the new reports from hospitals and medical centers around the country have raised concerns about the safety of face-down sleepers, particularly among parents who have heard stories of babies who died after sleeping face down.

The new findings have been published in medical journals and presented at scientific meetings. They have also been reported in the news media, which has led to a great deal of confusion and concern among parents and health care providers.

Parents are advised to follow the advice of their pediatrician or other healthcare provider. If you have any questions or concerns, please call your doctor or nurse practitioner.

Infants at Risk: Possible Factors

Despite research in many countries, the causes of crib death remain mysterious.

ADDICTION CITY



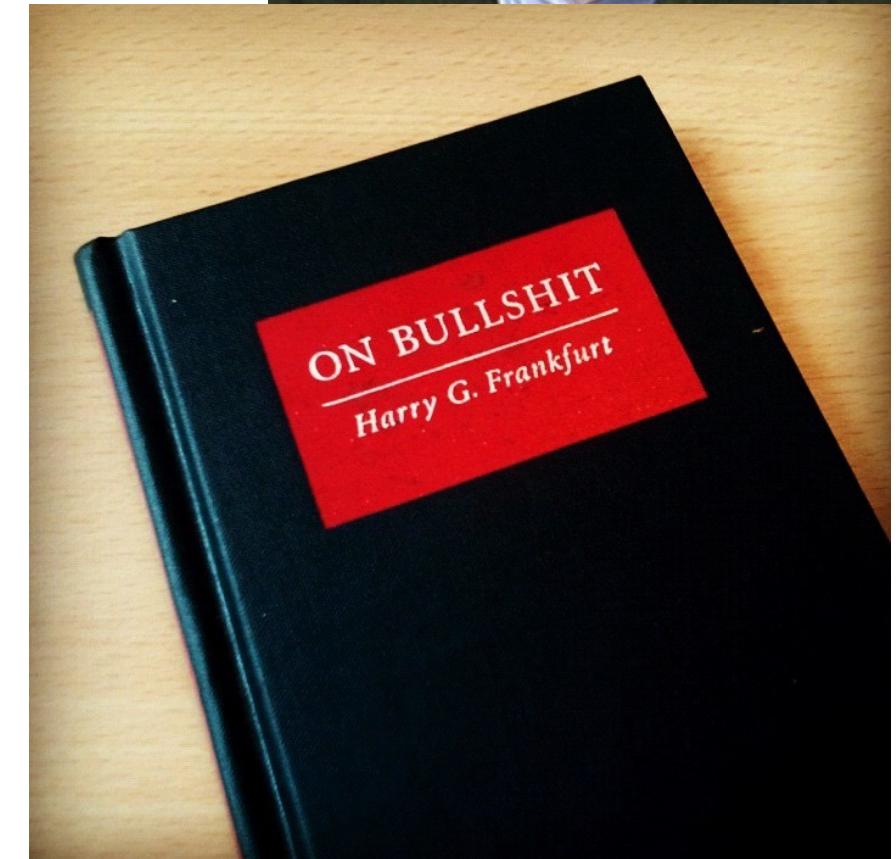
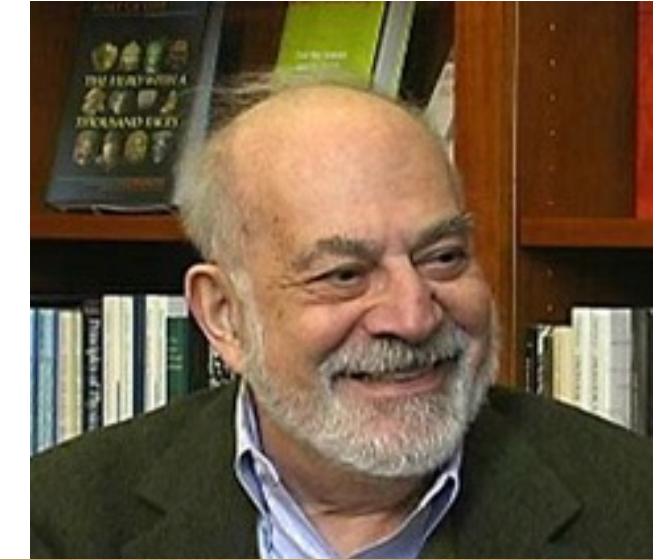
New York Times, August 10th, 1993

Problems with authority: bullshit

“One of the most salient features of our culture is that there is so much bullshit.”

—Frankfurt, 1986 (!)

Differs from lies!



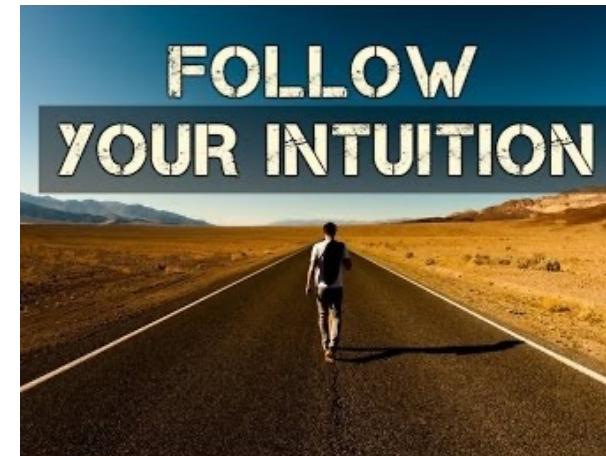
2. Intuition

- Commonly a starting point in science
- Draws from life (anecdotal) experience
- Sometimes correct
- Often wrong

Never apologize for trusting your intuition - your brain can play tricks, your heart can blind, but your gut is always right.

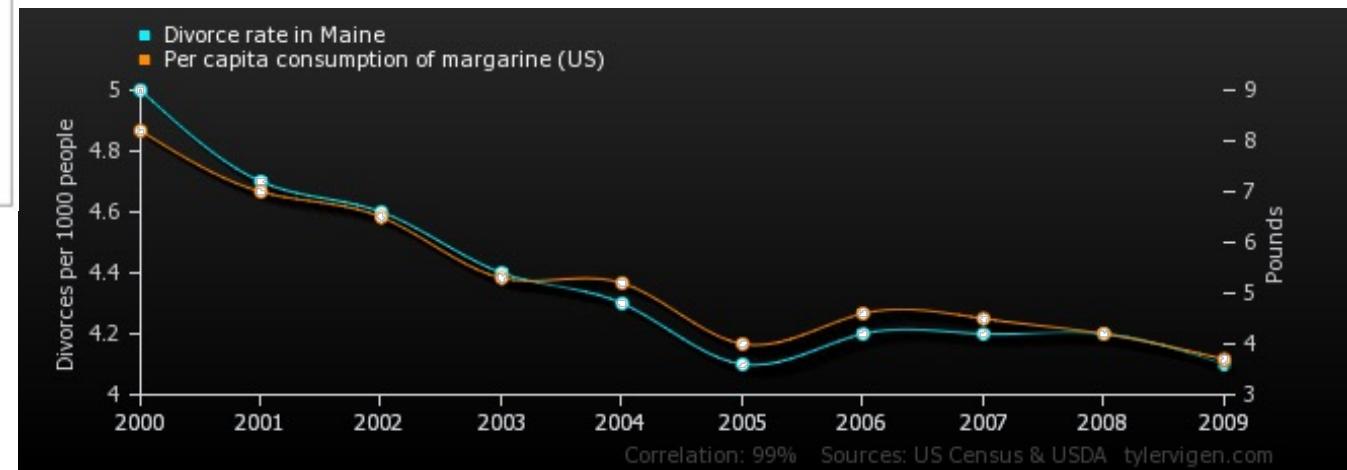
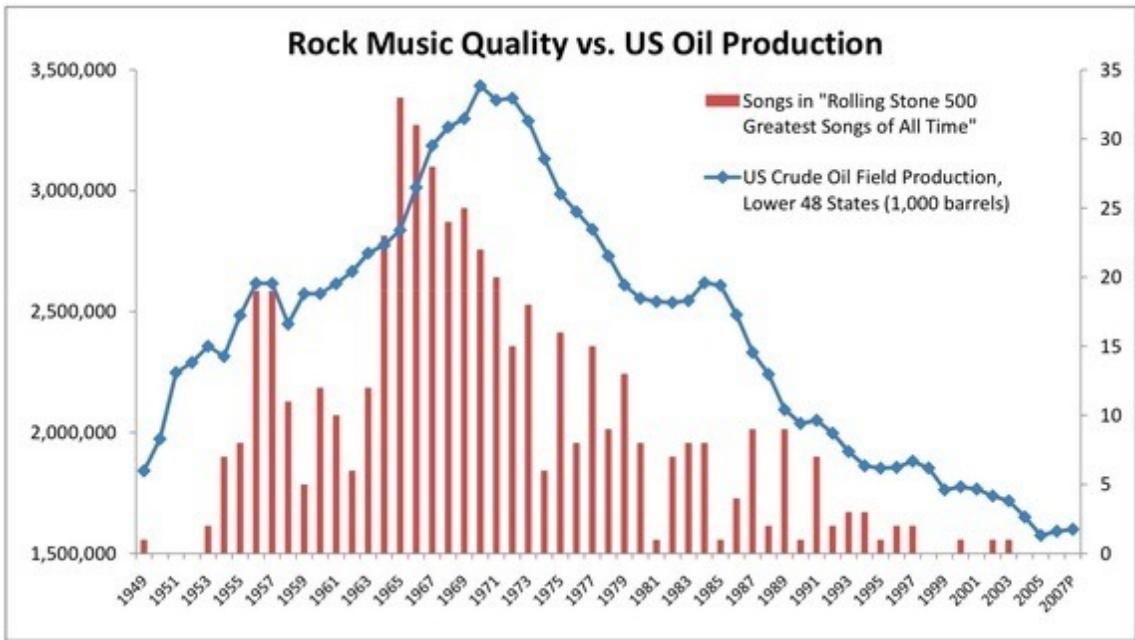


trust
your
intuition.
it never
lies.



Intuition

Problems with intuition: illusory correlation

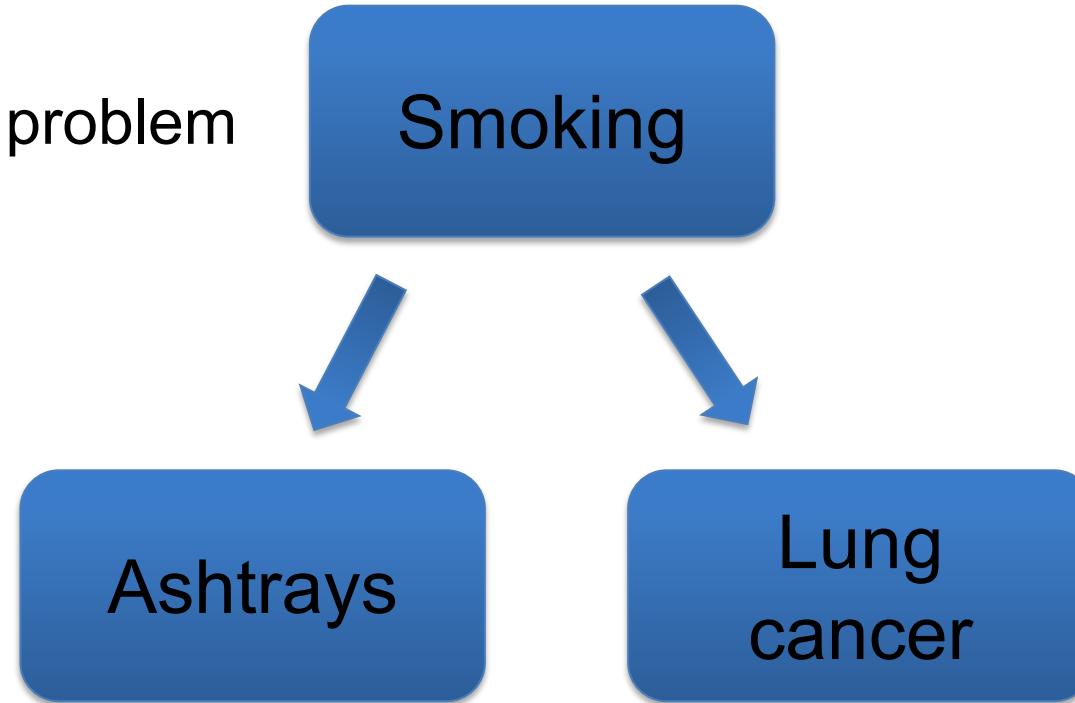


Problems with intuition: correlation ≠ causation



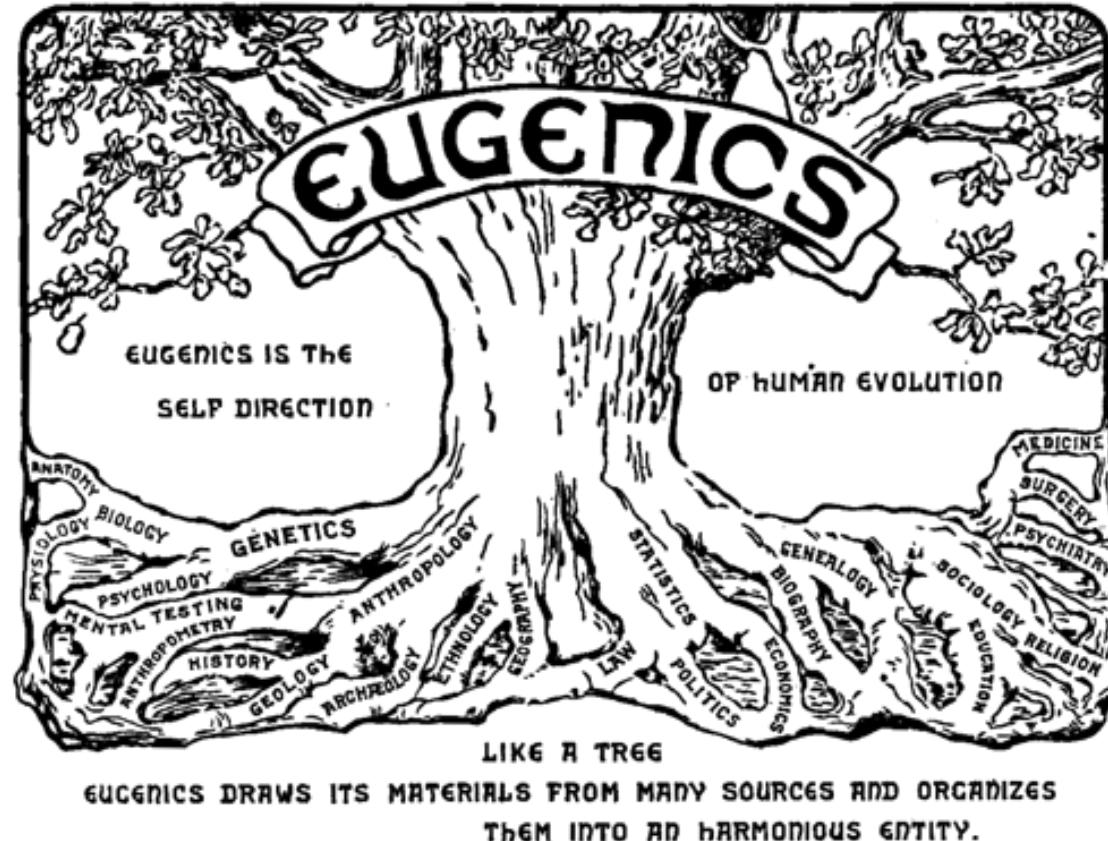
Problems with intuition: correlation ≠ causation

The third variable problem



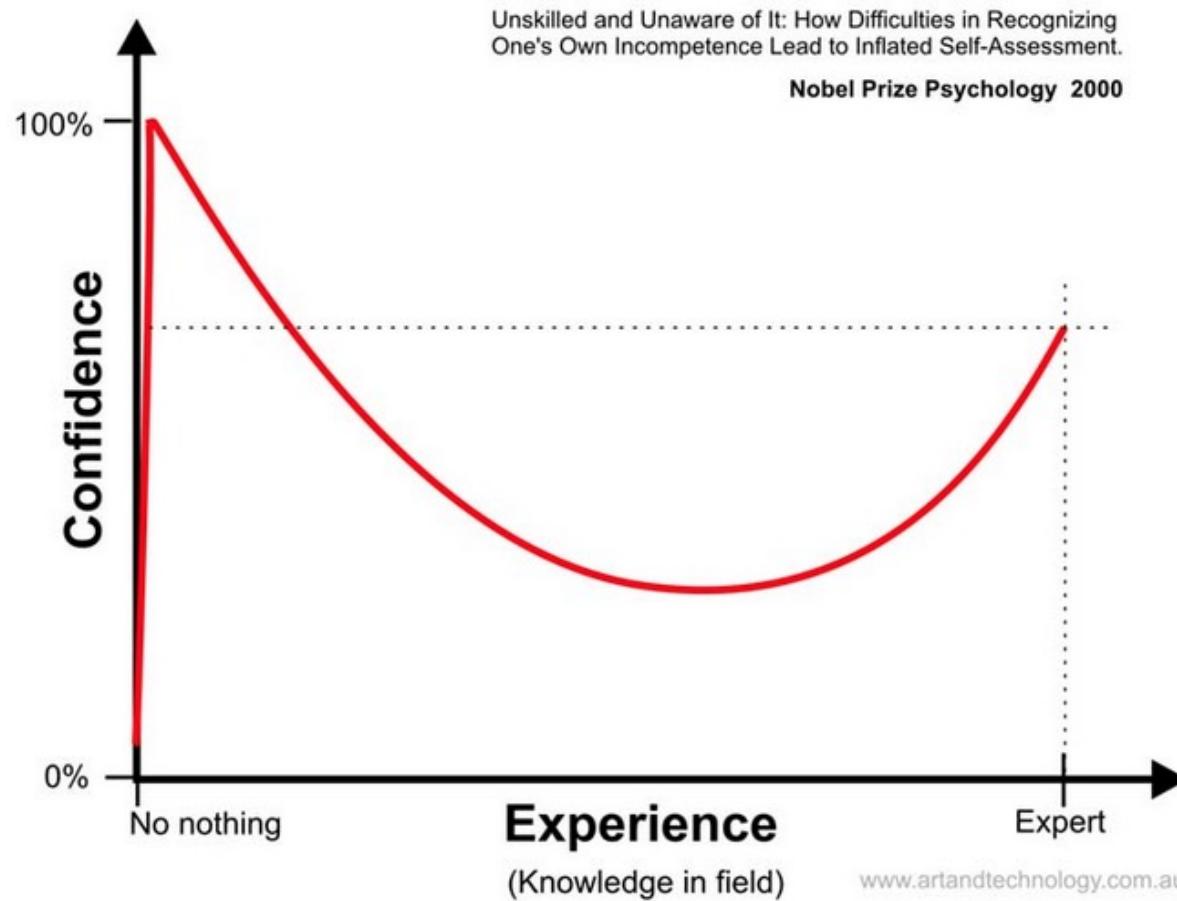
Intuition

Problems with intuition: susceptible to bias



Problems with intuition: overconfidence

- The Dunning-Kruger effect



Problems with intuition: we struggle with probability

- What's the probability of rolling a 6?



- I just rolled three 6s in a row?
What's the probability of rolling another 6?

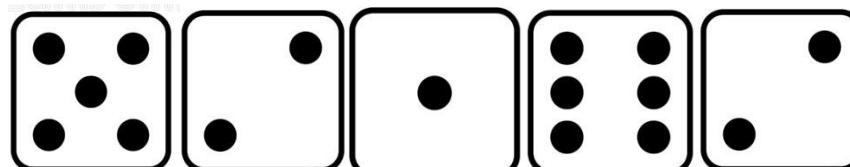


Gambler's fallacy

- I'm about to roll five dice. Which is more likely?



or



Intuition

Even more problems with intuition

- Confirmation bias
- Hindsight bias, aka creeping determinism
- Post-hoc explanations: not necessarily correct



Researchers have found that people with high self-confidence are more susceptible to flattery than those with low self-confidence.

Does this make sense? Why?

“Flattery will get you everywhere.”
-Mae West



Intuition

Researchers have found that people with low self-confidence are more susceptible to flattery than those with high self-confidence.

Does this make sense? Why?

“Flattery will get you everywhere.”
-Mae West



Intuition

(Which one is it?)

Br. J. soc. clin. Psychol. (1978), 17, 25–29 Printed in Great Britain

25

Reactions to flattery as a function of self-esteem: Self-enhancement and cognitive consistency theories

Andrew M. Colman and Kevin R. Olver

Male subjects who had previously scored either very high or very low on a self-esteem scale were interviewed about personal characteristics, biographical details, social activities, etc. They then received, via closed-circuit television, flattering or neutral character assessments which were apparently based on their performance in the interviews. A highly significant interaction ($P < 0.001$) showed that whereas the subjects of high self-esteem responded with far greater liking for the evaluator in the flattery than in the neutral condition, those of low self-esteem somewhat preferred the neutral evaluator. These findings provide clear-cut support for the cognitive consistency theory regarding reactions to flattery, but do not rule out a concomitant though weaker self-enhancement effect.

(But...)

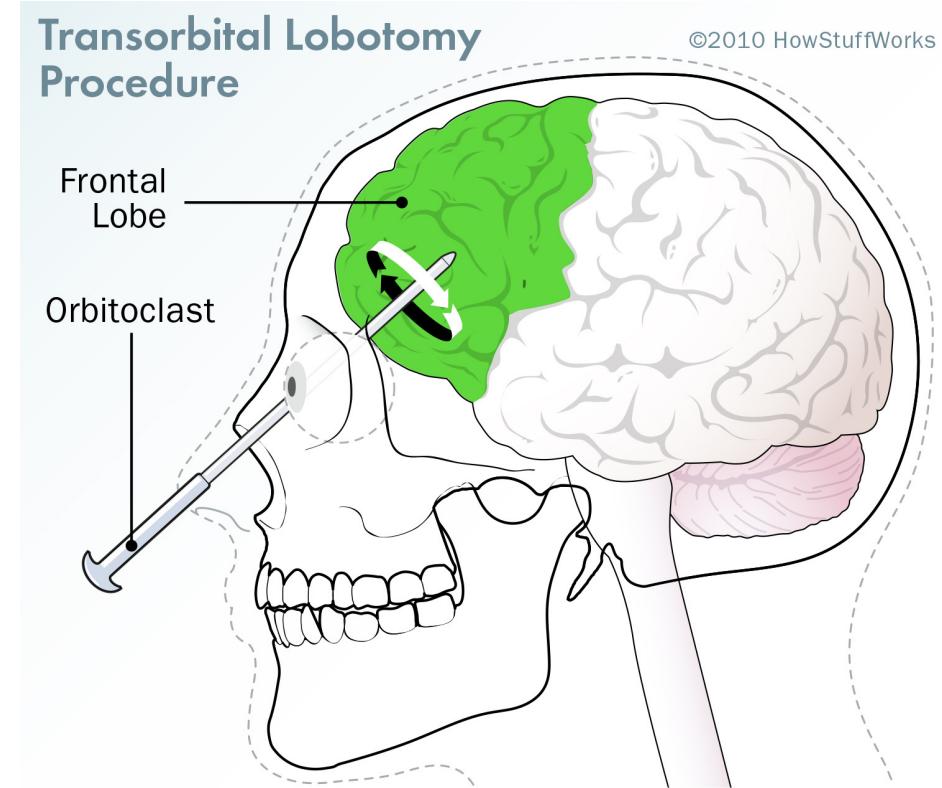
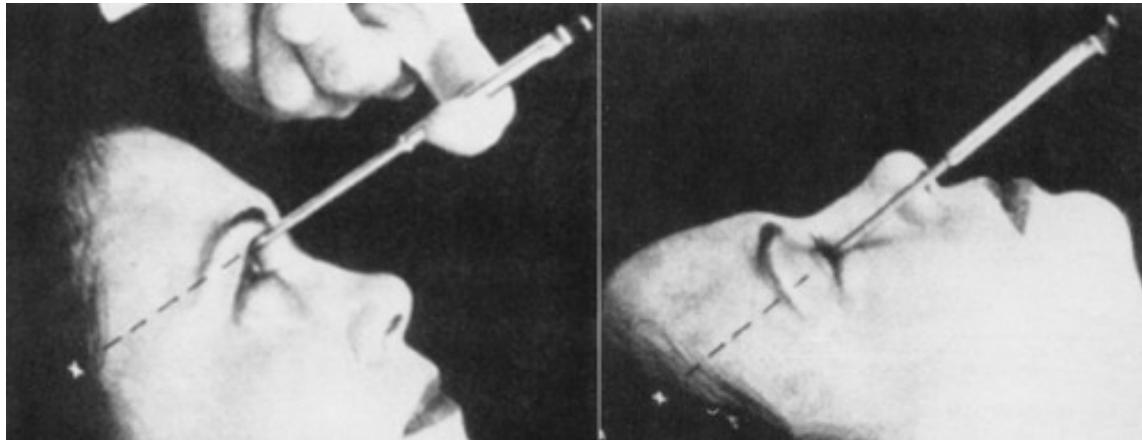
3. Observation

- Critical to good science: empiricism
- Works best with objective measures
- Still not enough to acquire the best information about the world...



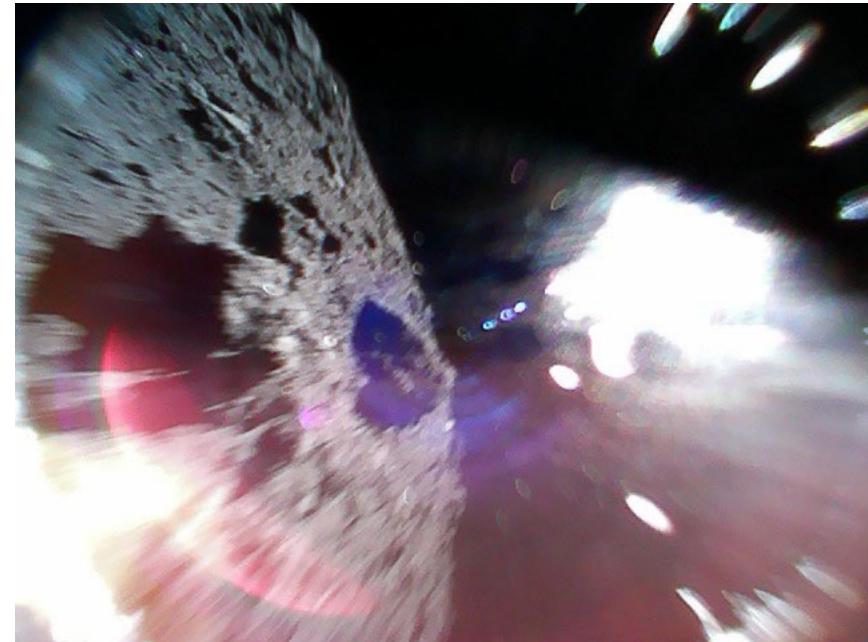
Observation

Problems with observation: bias/limited explanatory power



Scientific skepticism

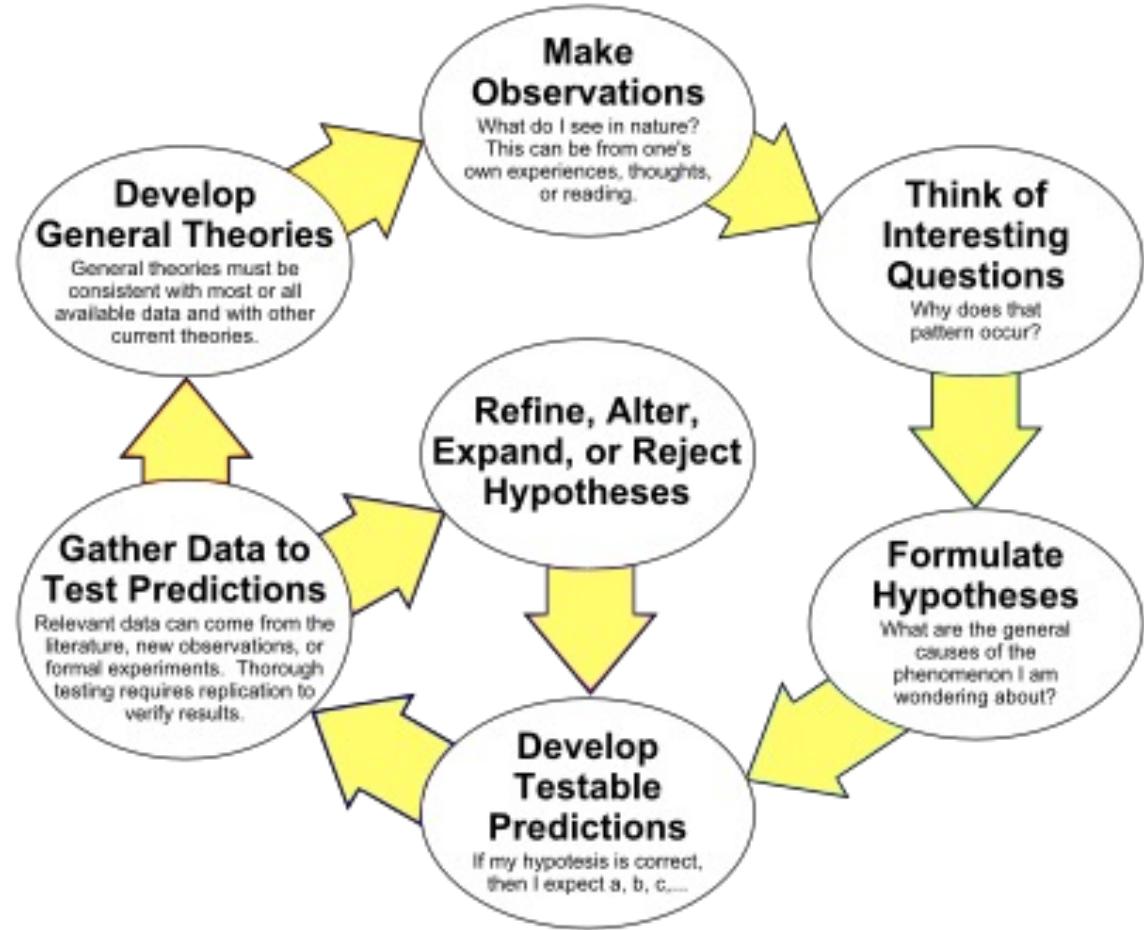
- Question authority and intuition
- Question your senses
- Question knowledge, beliefs
- Systematic doubt and continual testing
- BUT be careful of extreme skepticism / extreme postmodernity:
these are the tools of obfuscation



Skepticism is the beginning of Faith.
(Oscar Wilde)

The scientific method

- Observation
- Idea
- Consult past research
- Hypothesis
- Design study
- Ethical approval
- Collect data
- Analyze data
- Modify and repeat (if hypothesis wrong), or
- Consider implications of results, build theories



The scientific method

The Scientific Method (part 2)

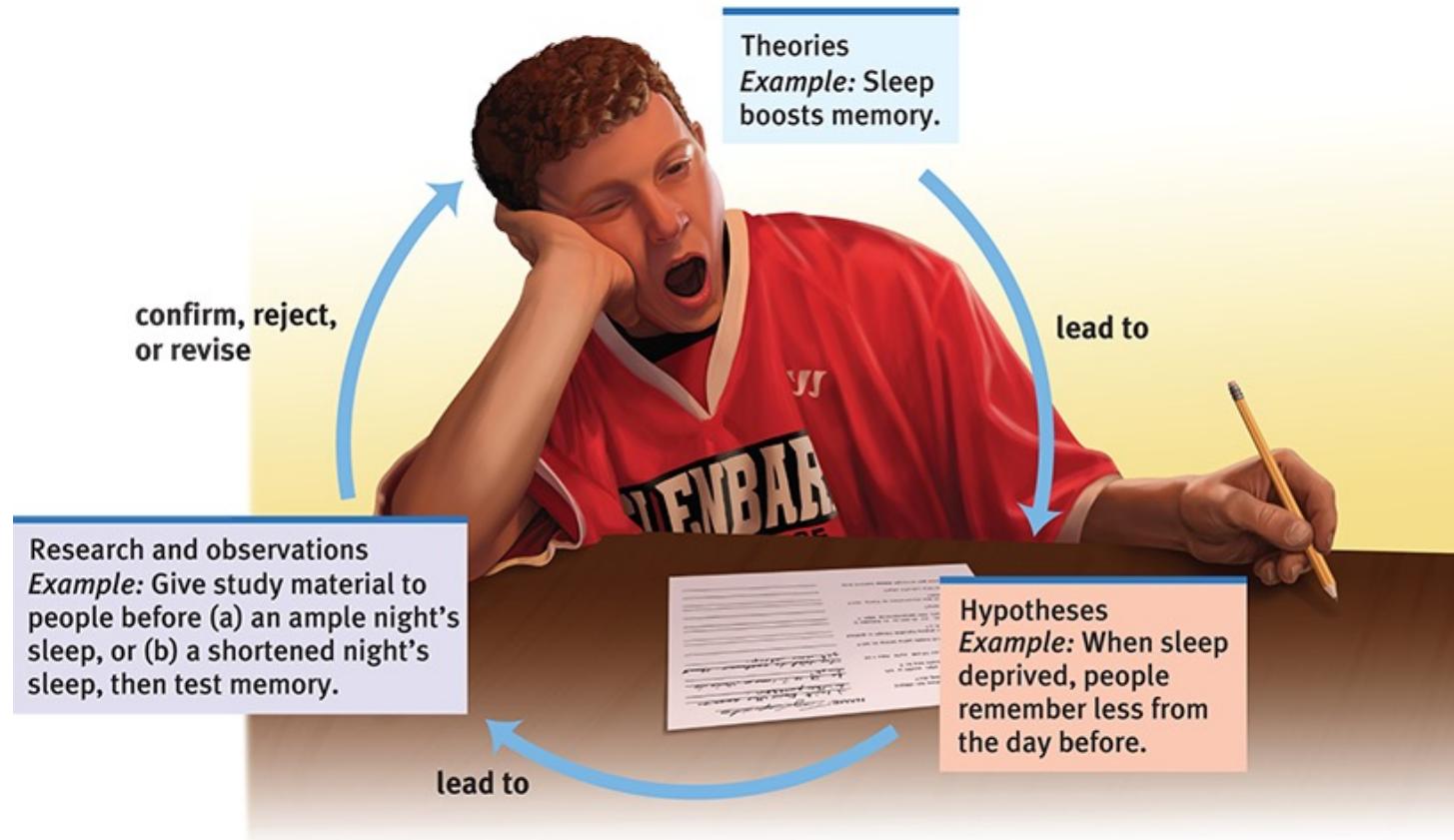
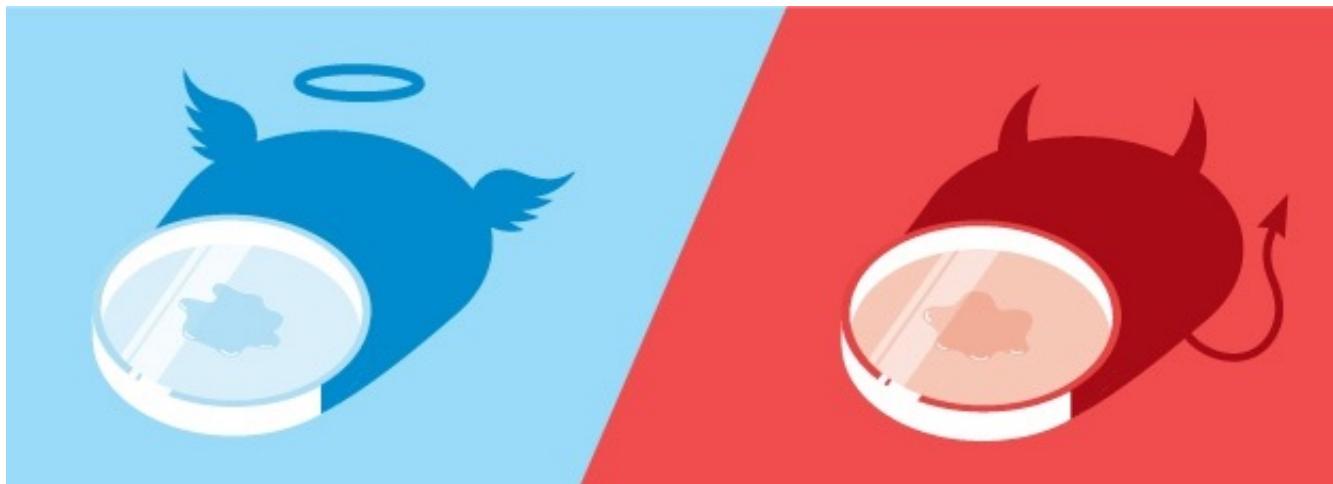


FIGURE 1.1 Myers/DeWall, *Psychology*, 12e, © 2018 Worth Publishers

The scientific method

Good science

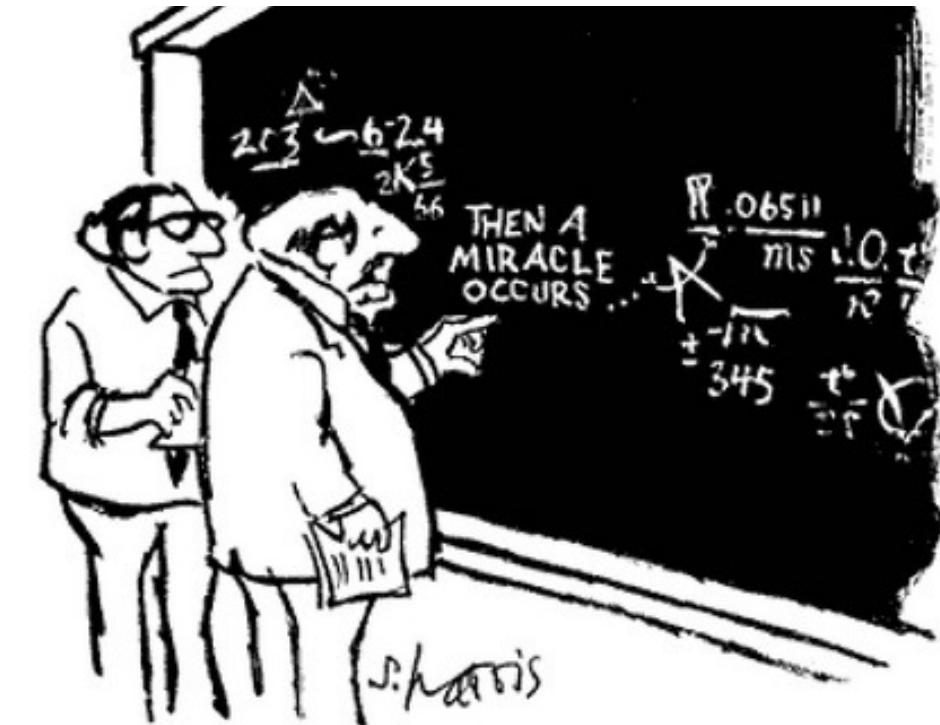
- Materialism
- Universalism
- Communality
- Disinterestedness
- Organized skepticism



The scientific method

Developing a theory

- “Theory”
 - Common use \neq scientific use
- Organize and explain a variety of facts/descriptions/observations
- Falsifiable
- Generate new knowledge
- Parsimonious



"I think you should be more explicit here in step two."

The scientific method

Pseudoscience

- Often relies on authority
- Emphasis on scientific-sounding jargon
- Not falsifiable
- Poor/no methodology
- Poor/no/anecdotal evidence
- Not peer reviewed
- Ignores/conflicts with known/existing evidence
- Vague claims
- Often reinforces status quo or a worldview
- Does not facilitate further research

The scientific method

FOKAS
ADVANCED COGNITIVE SUPPORT
#1 RATED ALL NATURAL SMART PILL

Potent Focus Factors

- INTENSE FOCUS Clears Your Mind For Optimum Mental Absorption
- MENTAL CLARITY Enhances Neurotransmitters in the Brain Naturally
- COGNITIVE PRECISION Stores New Learned Information Efficiently
- EFFECTIVE NOOTROPIC Proven Scientific Ingredient Profile That Works

Fokas Brain Booster

GET YOURS NOW!

WHERE DO WE SEND YOUR DISCOUNTED BOTTLE?

First Name: Last Name:
Address: City:
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Phone: Email:

YES, MAKE ME SMARTER [http://www.fokasbrain.com/](#)



NO GIRLFRIEND?

Attract Women with New Pheromone Cologne

Try it Absolutely Risk FREE!

Click Here ►

How Pheromones Induce A Sexual Response

1 Glands in our armpits, genital regions, and navels secrete a clear liquid that contains pheromones.

2 Our pheromone scent reaches the noses of women.

3 The olfactory system (starting with the nose) bypasses the RATIONAL brain.

4 This information is fed directly to the behavior center in a woman's brain.

5 If the information communicated by our pheromone scent is positive (i.e. this guy is healthy, fit & fertile), then a sexual response may be observed.

Goals of psychological research

- Describe behaviour
- Predict behaviour
- Determine causes of behaviour
- Influence/control behaviour (?)

facebook

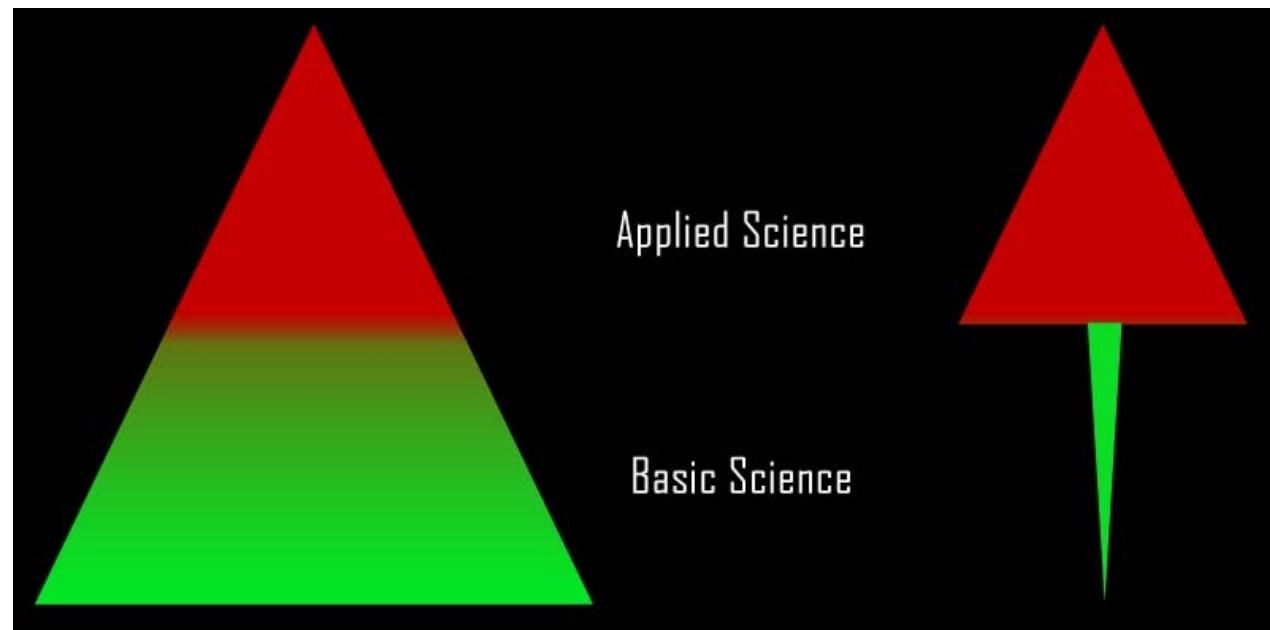


- Example 1: Facebook (Kramer *et al.* 2014)
- Example 2: Marshmallow task (video)

<https://www.youtube.com/watch?v=BLtQaRrDsC4>

Types of research

- Basic research
- Applied research



Research design

Research design basics

Variable



Conceptual Variable → **Measured Variable**

Operational Variable

Four general categories of variables



Independent Variable

Dependent Variable

Situational Variables

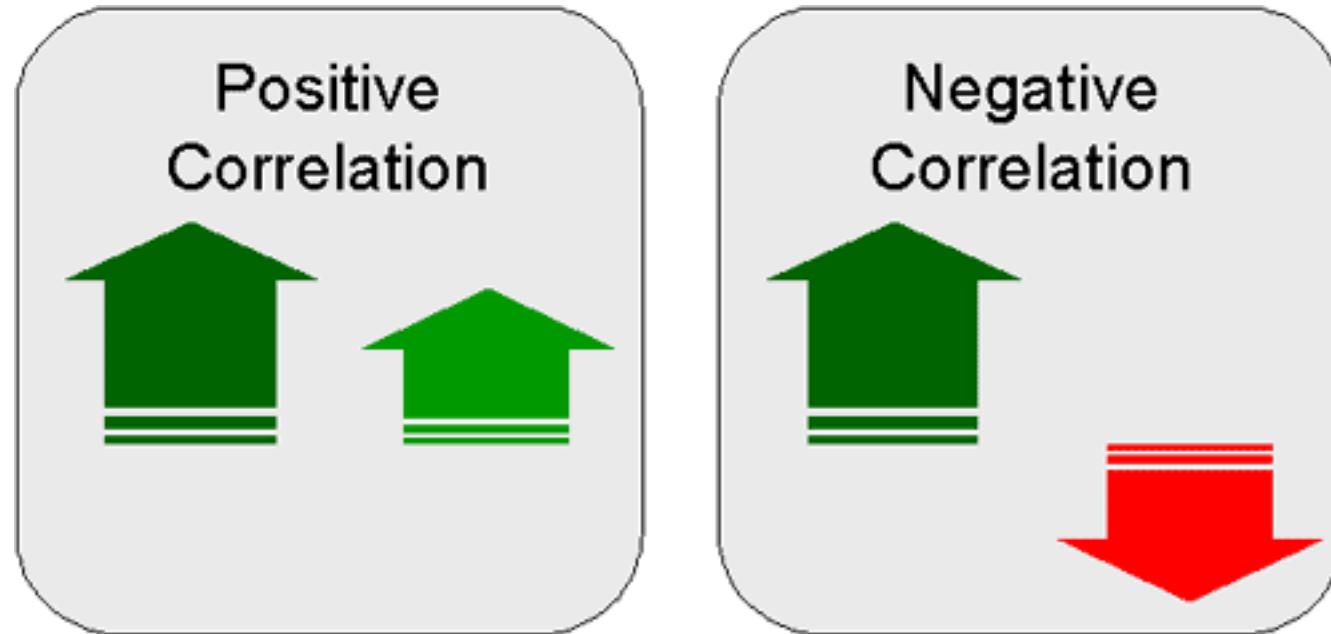
Participant Variables

Random assignment

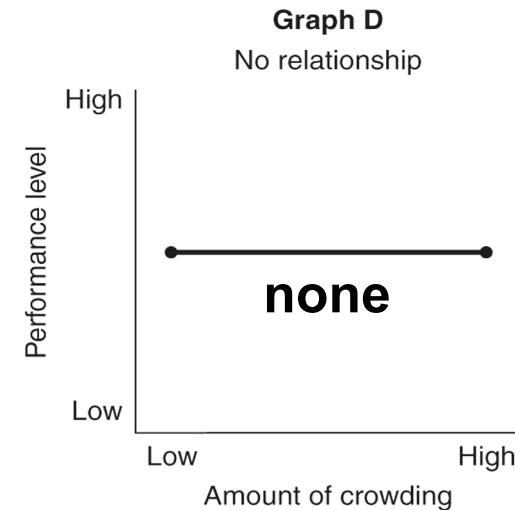
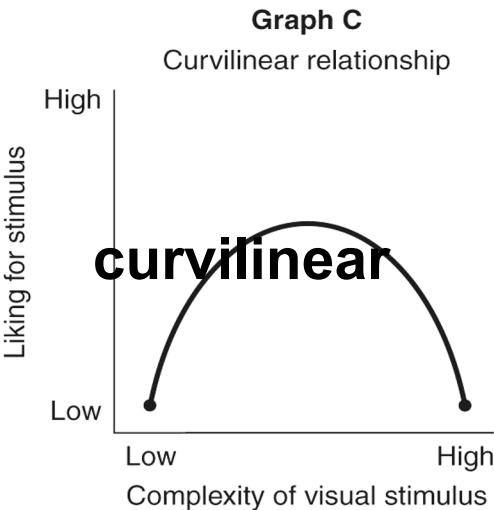
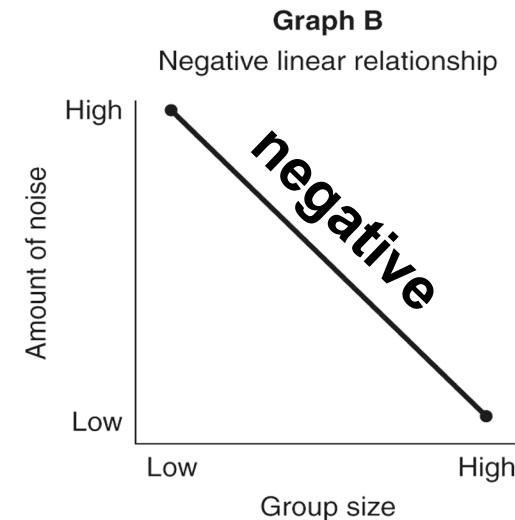
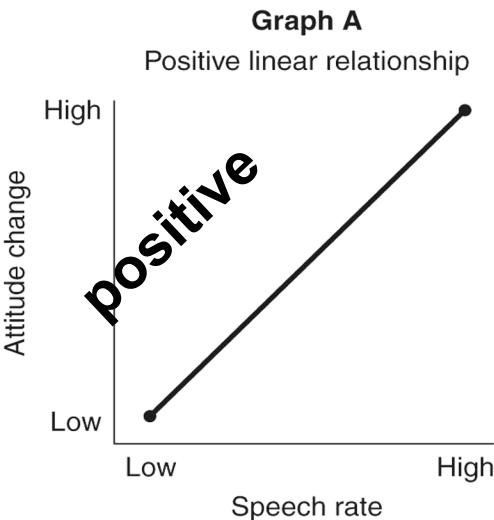
Research design

Relationships Between Variables

Non-experimental Method: Correlation Research

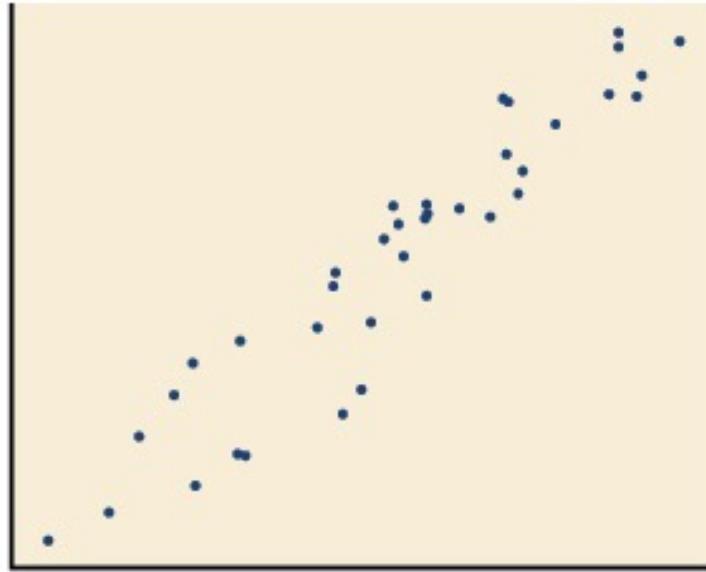


Relationships Between Variables



Relationships Between Variables

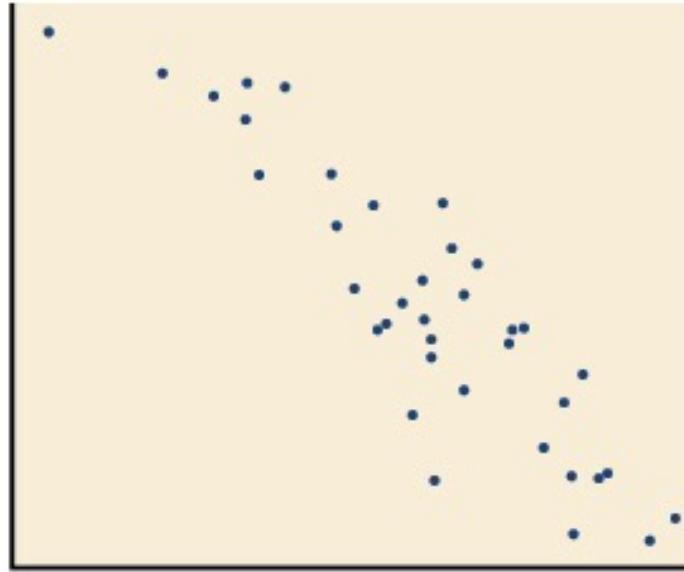
Height



Weight

(a) Positive Correlation

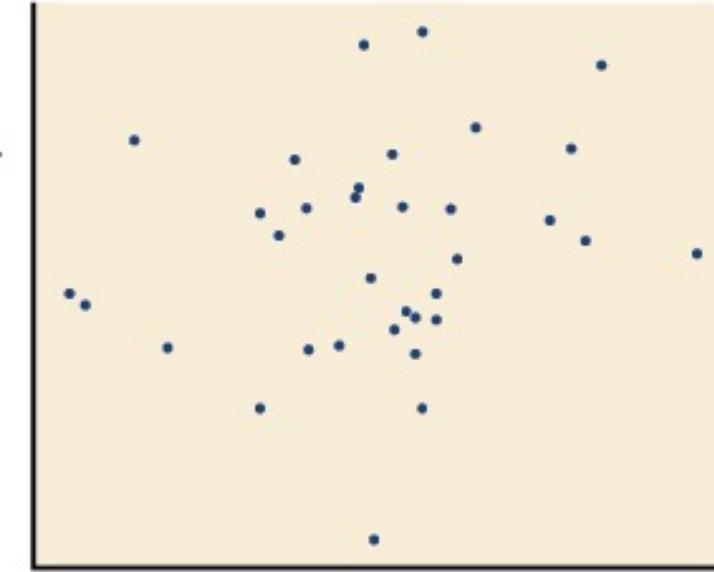
Hours of sleep



Tiredness

(b) Negative Correlation

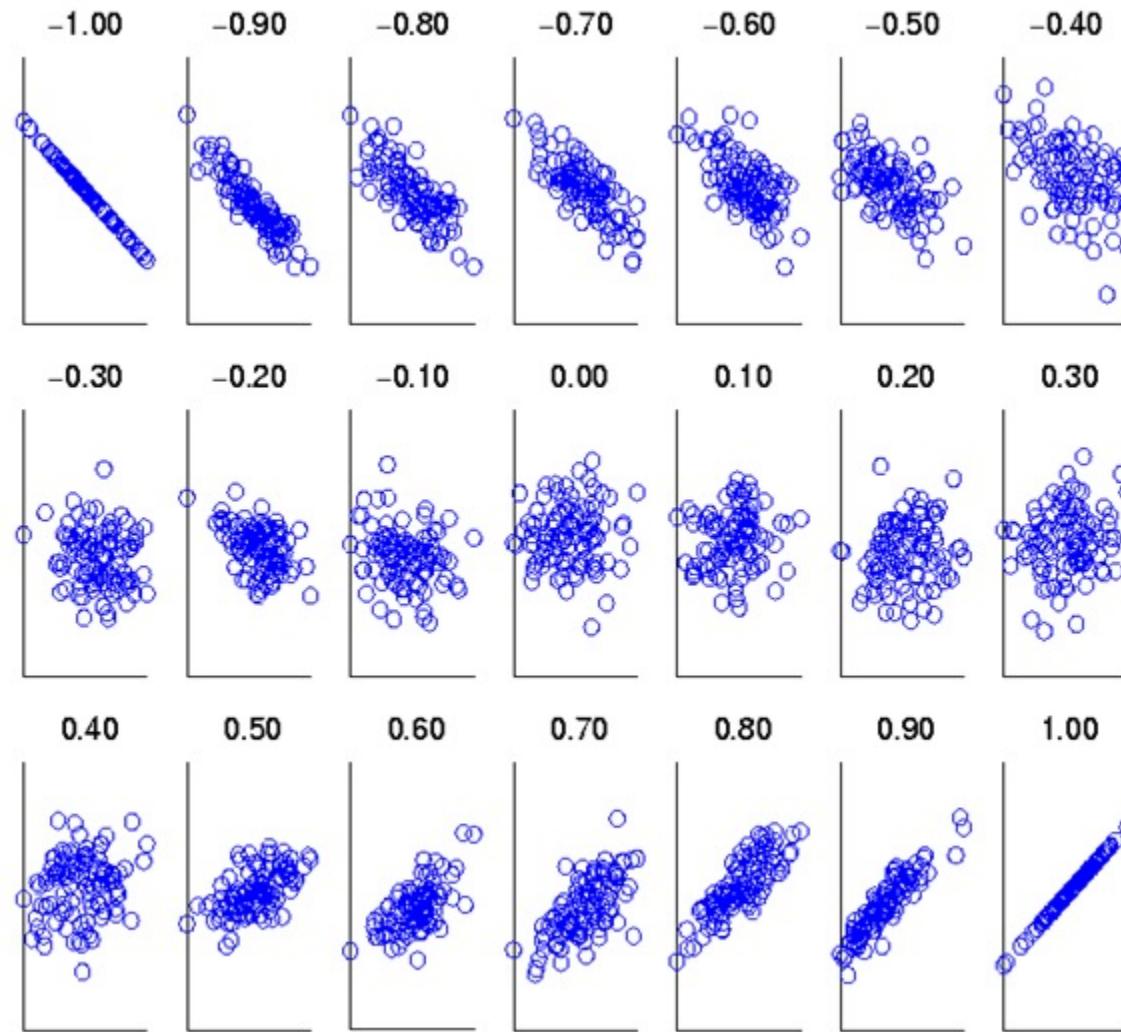
Hours of sleep



Shoe size

(c) No Correlation

Relationships Between Variables



Correlation: r
From -1 (perfect negative correlation)
To 1 (perfect positive correlation)

Relationships Between Variables

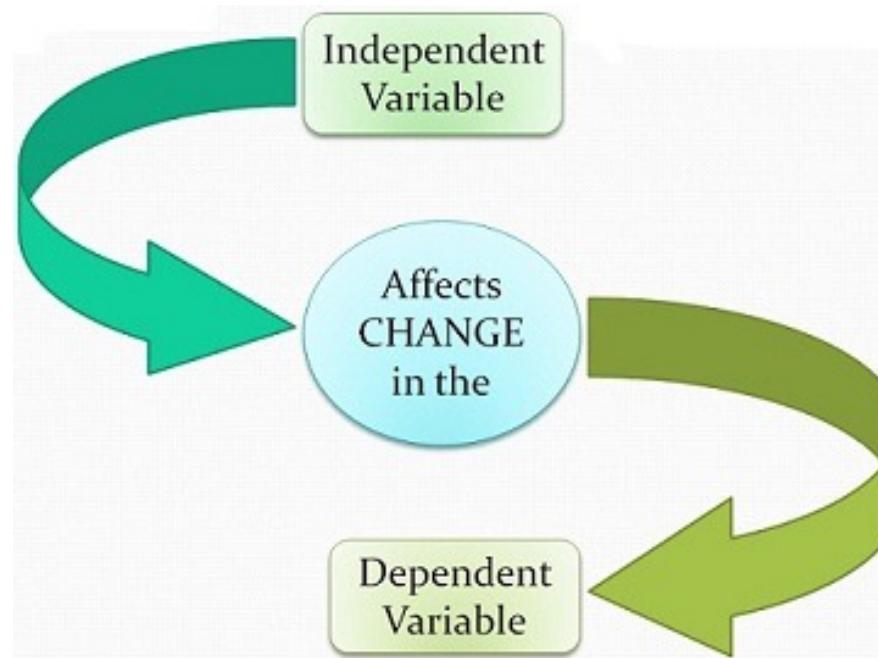
**Issue with correlation:
the third-variable problem**



Relationships Between Variables

Experimental Method

Independent Variable Dependent Variable



Causality

- Covariation of cause and effect
- Temporal precedence
- No more plausible alternative explanation

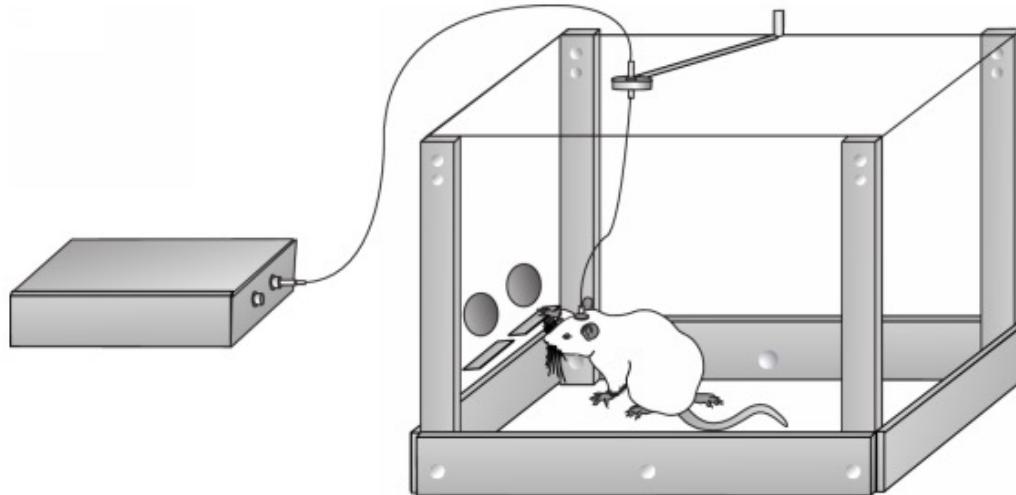


Research design

Relationships Between Variables

Experimental Method

Confounding Variable



- e.g. 1: drug injection
- e.g. 2: brain region inactivation
- e.g. 3: drug self-administration

Example: Clinical Drug Studies

- Placebo as control
 - Exception: if treatment already exists
- Treatment arms
- Blinded procedures
 - Single blind
 - Double blind
 - Open label



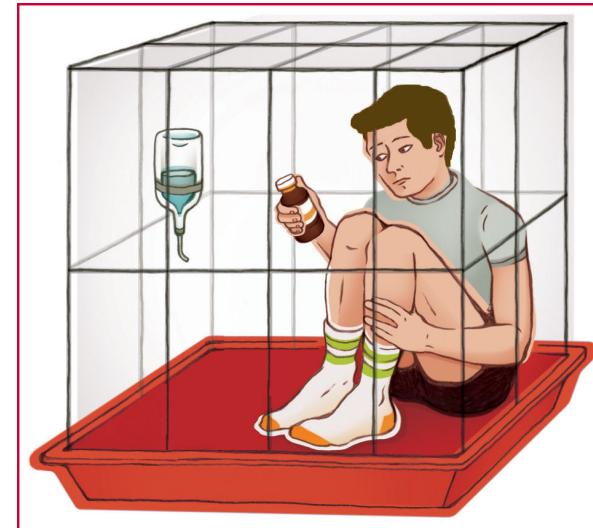
Animal Models for Research

- Animals are used for research:
 - Understand basic mechanisms, genetics, etc.
 - Because there are no viable alternatives
 - Because they have high predictive value
 - Have a number of protections in place
(e.g. CCAC, ACC)



Human Research

- Ethical considerations must be made
 - Federally mandated committees review human research proposals
 - Informed consent



Research design

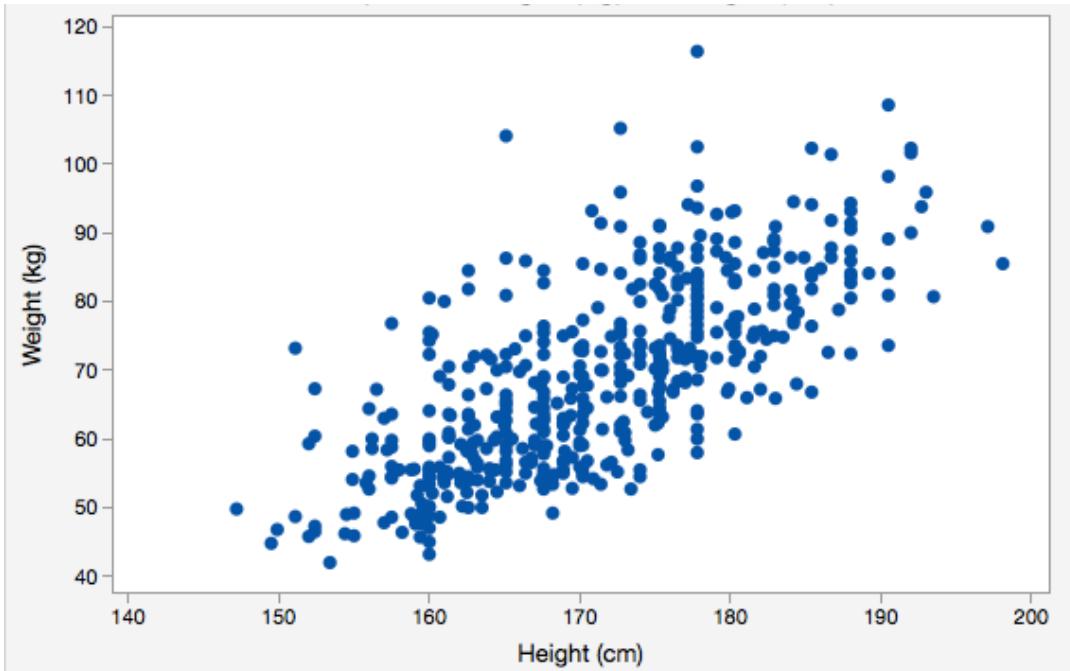
Your turn!

Design an experiment to test which drink people like better, Coca Cola or Pepsi. What are your independent variables? What are your dependent variables? What are your other variables? What are some potential confounding variables, and how will you avoid them?

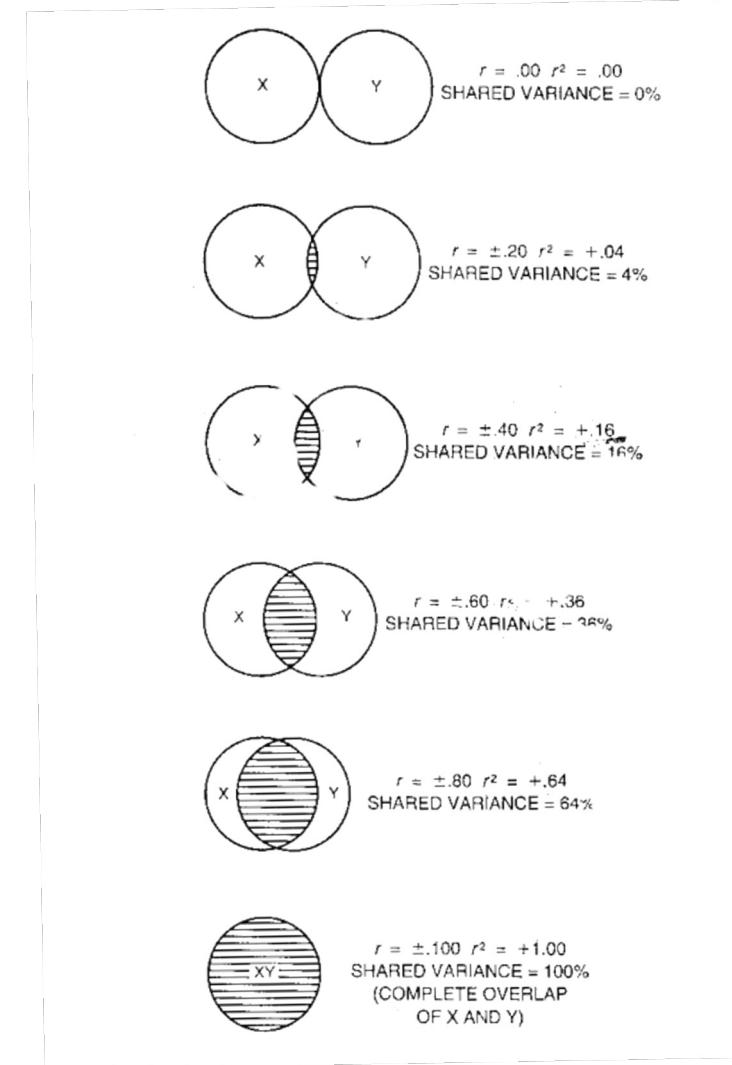


In-class “assignment”

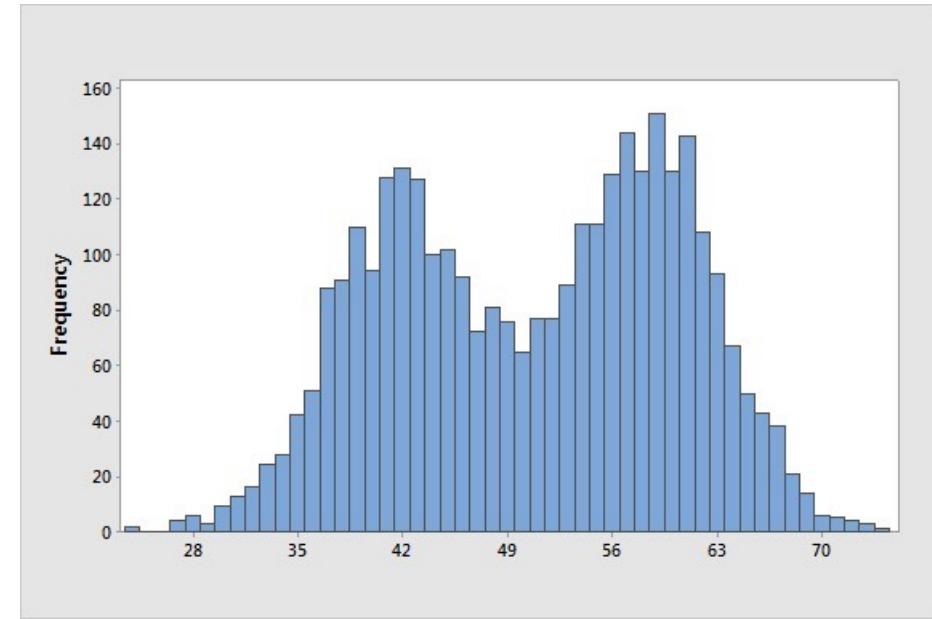
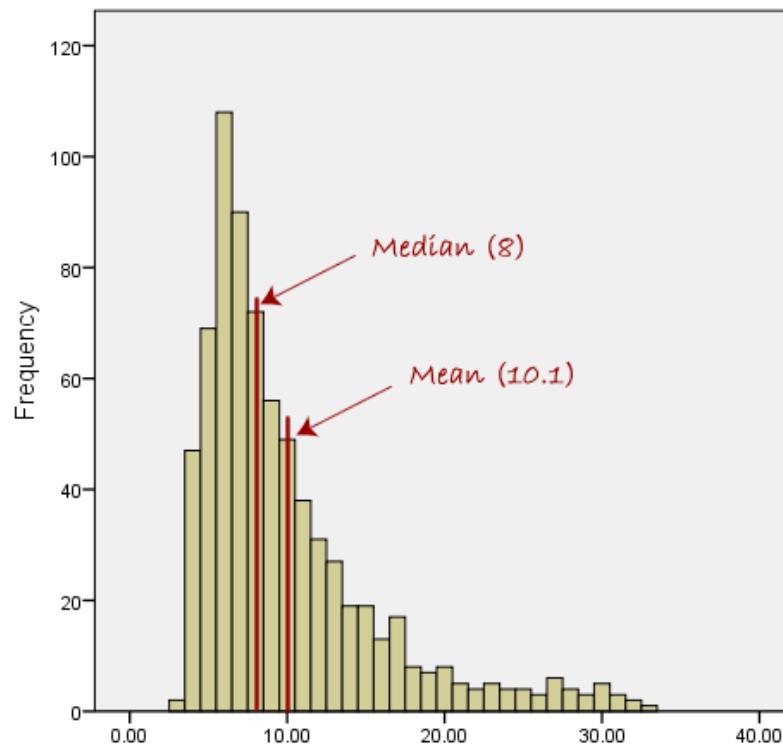
Correlations revisited



Generally people use r^2 , not r
Gives shared variance in sample
if $r = 0.3$, then $r^2 = 0.09$, or 9%

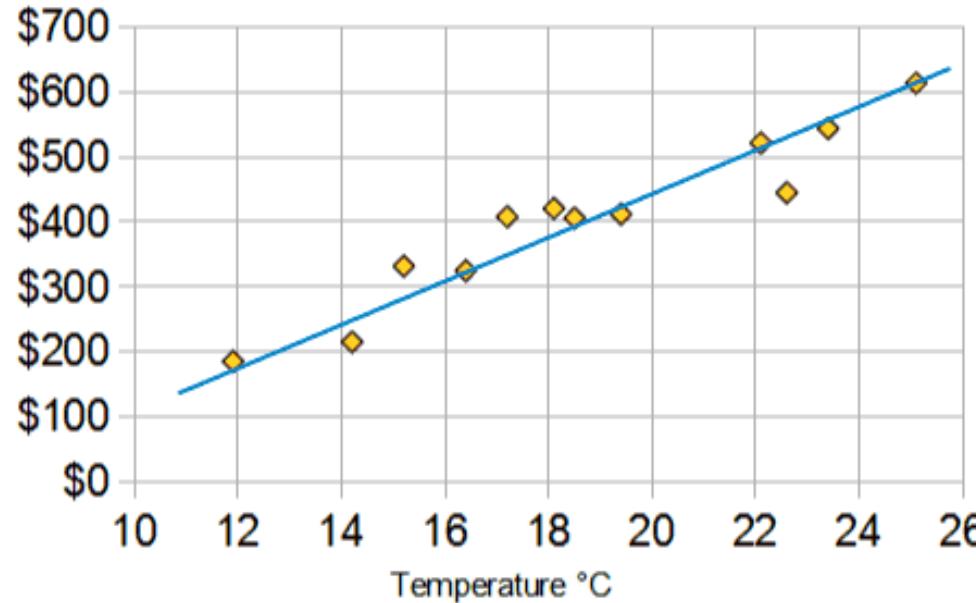


Mean, median, mode



Important for understanding and splitting up your data
These are **histograms**

The standard regression equation



$$y = mx + b$$

Annotations for the regression equation:

- Dependent Variable: Points to the y variable.
- Indendent Variable: Points to the x variable.
- Where line crosses the y -axis: Points to the b term.
- Y- Intercept: Points to the b term.
- Coefficient, Rate and Slope of line: Points to the m term.

i.e. The line of best fit

$$y = mx + b$$

If you have this equation, and you have x ,
you can predict y

Standard deviation and standard error

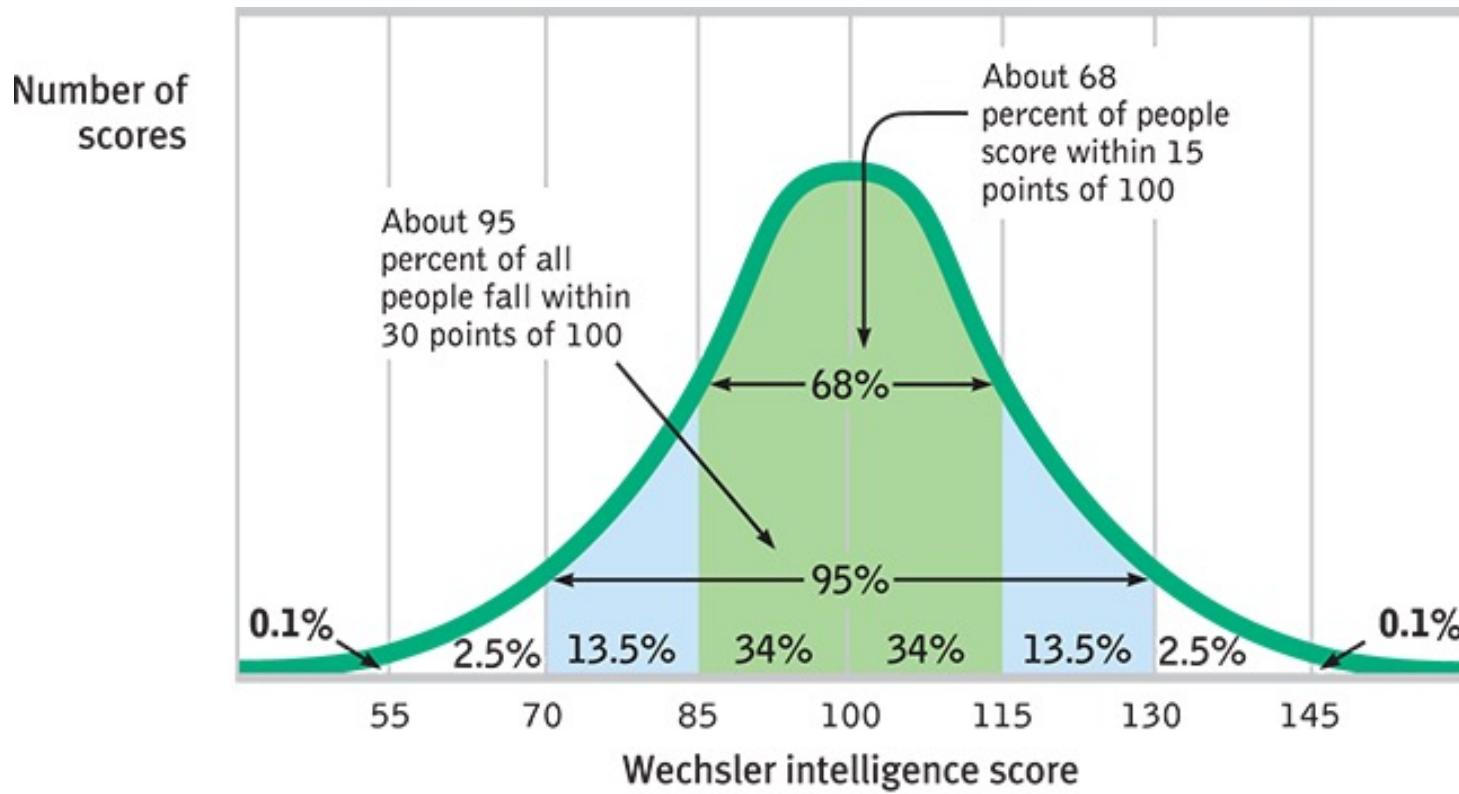
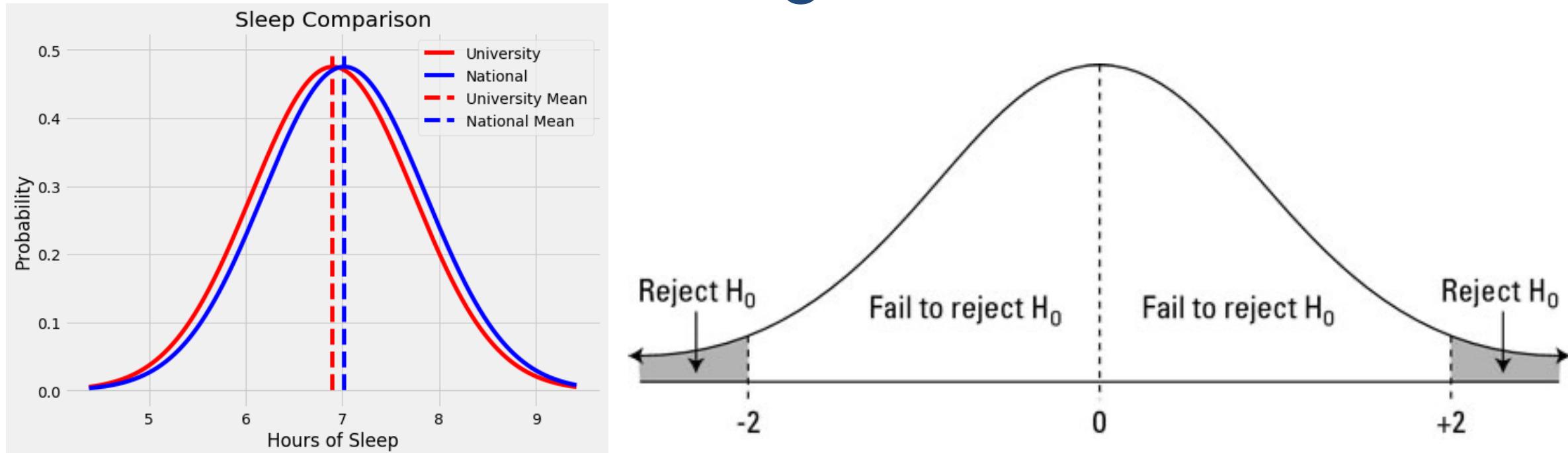


FIGURE 1.9 Myers/DeWall, *Psychology*, 12e, © 2018 Worth Publishers

Standard deviation: tells you how wide the normal curve is,
i.e. how much variance there is in your data

Standard error: how far the sample mean is from the population mean

Statistical significance



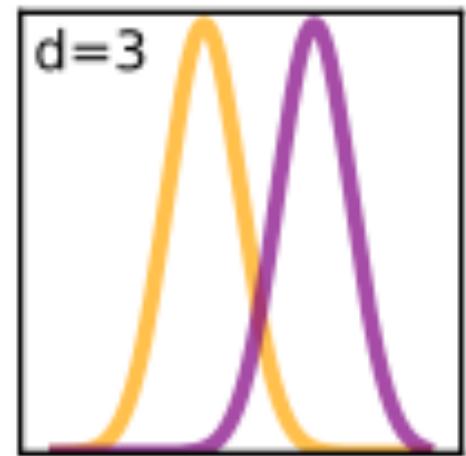
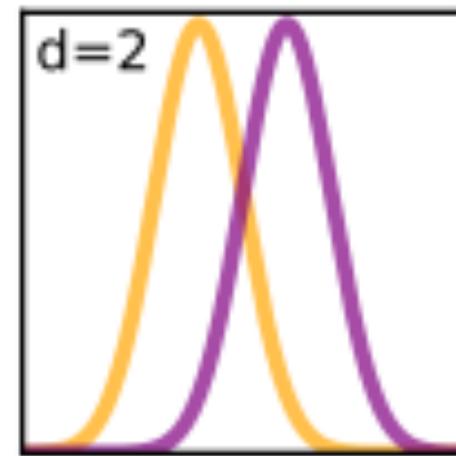
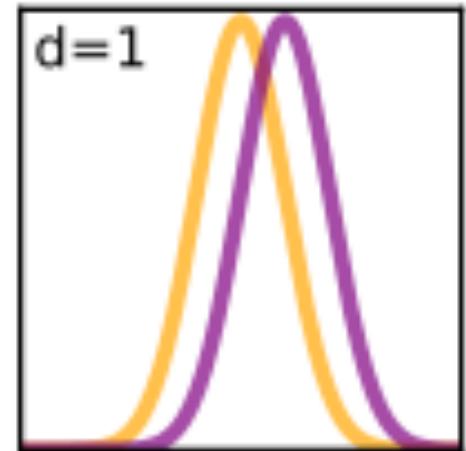
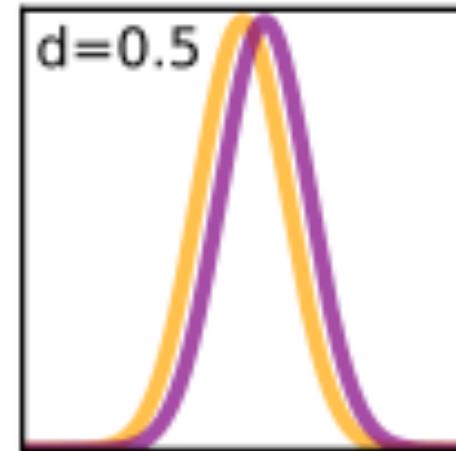
i.e. p

Comparing test measurement to control measurement,
while taking the sample size into account

Typically, significance level is $p < 0.05 \leftarrow$ meaning?

Gives likelihood of correct measurement, *not* effect size

Effect size



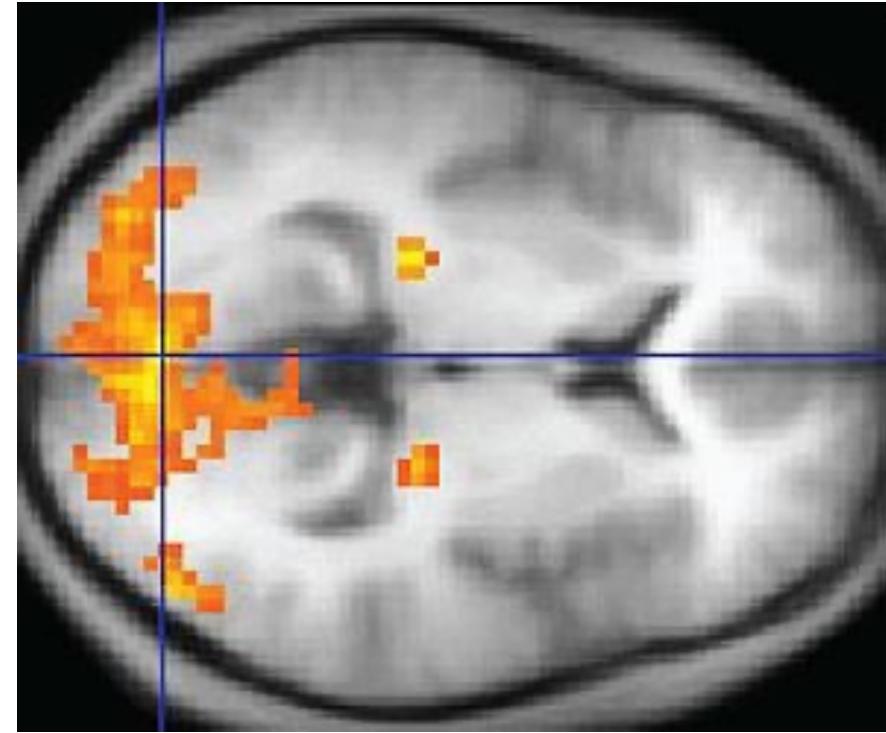
e.g. Cohen's d

Note: r is also a measure of effect size!

Tells us magnitude of effect of IV on DV

Very important, often overlooked

Need for higher significance level?



Sometimes!
Consider: fMRI
~60,000-1,000,000 voxels for brain scan
Every voxel requires a statistical test
If $p = 0.05$, how many false positives?
Must *correct for multiple comparisons*

P hacking

EATING OR DRINKING	IS LINKED TO	P-VALUE
Raw tomatoes	Judaism	<0.0001
Egg rolls	Dog ownership	<0.0001
Energy drinks	Smoking	<0.0001
Potato chips	Higher score on SAT math vs. verbal	0.0001
Soda	Weird rash in the past year	0.0002
Shellfish	Right-handedness	0.0002
Lemonade	Belief that "Crash" deserved to win best picture	0.0004
Fried/breaded fish	Democratic Party affiliation	0.0007
Beer	Frequent smoking	0.0013
Coffee	Cat ownership	0.0016
Table salt	Positive relationship with Internet service provider	0.0014
Steak with fat trimmed	Lack of belief in a god	0.0030
Iced tea	Belief that "Crash" didn't deserve to win best picture	0.0043
Bananas	Higher score on SAT verbal vs. math	0.0073
Cabbage	Innie bellybutton	0.0097

SOURCE: FFQ & FIVETHIRTYEIGHT SUPPLEMENT



Construct validity



- CRITICAL!

Indicators of construct validity:

- Face validity



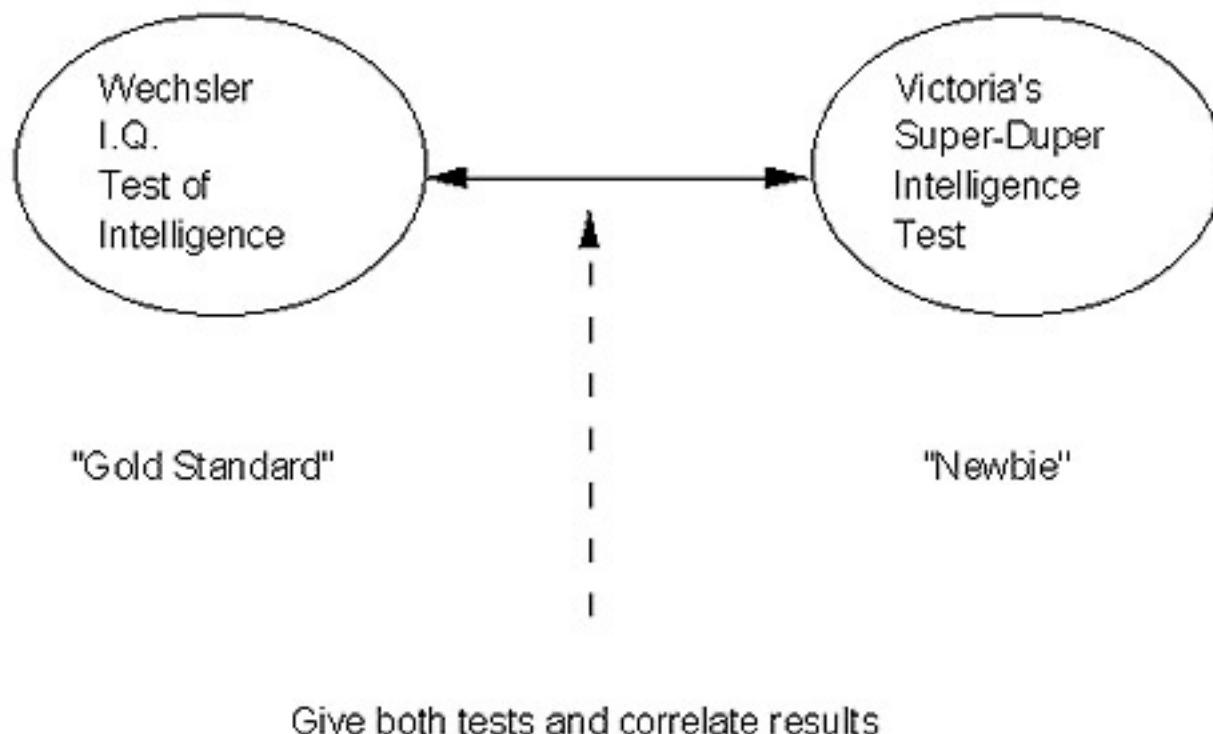
Indicators of construct validity:

- Content validity



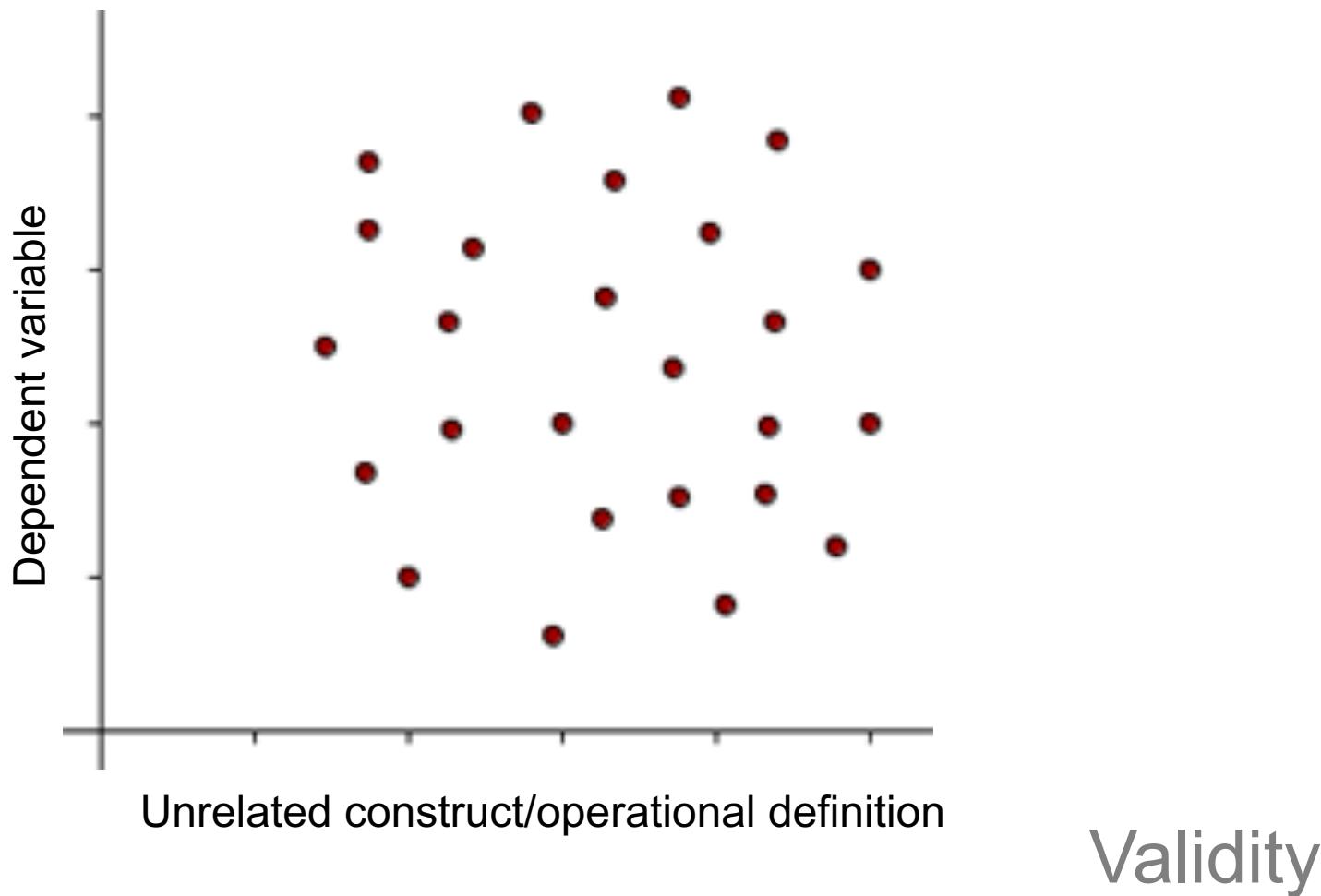
Indicators of construct validity:

- Concurrent and convergent validity



Indicators of construct validity:

- Discriminant validity



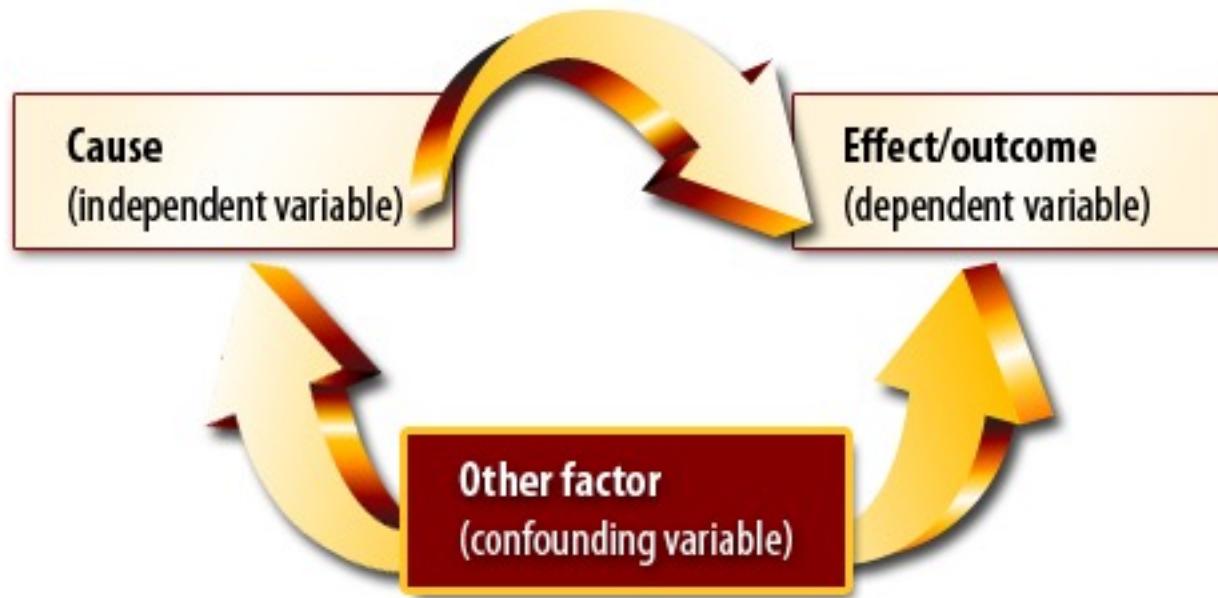
Indicators of construct validity:

- Predictive validity



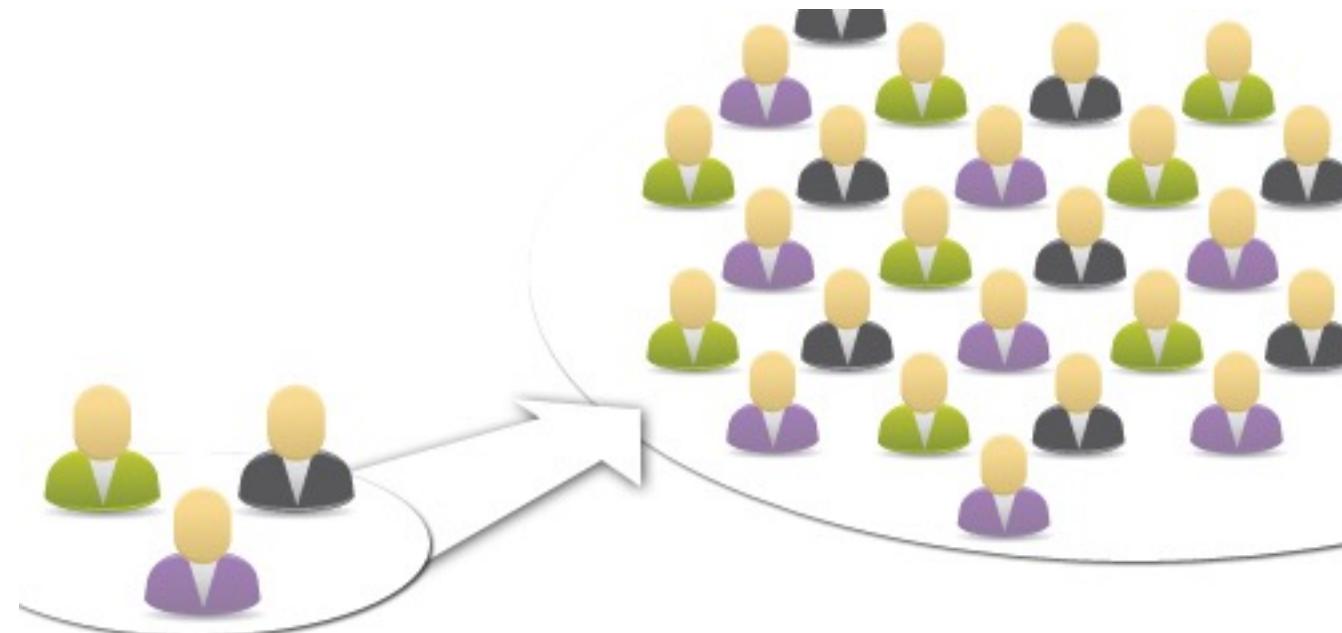
Types of validity:

- Internal validity



Types of validity:

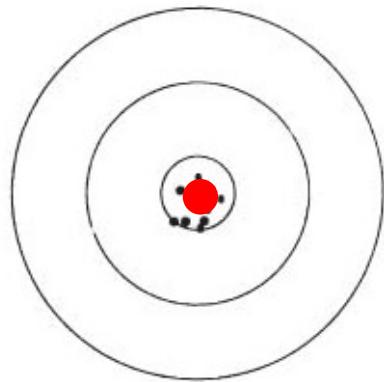
- External validity



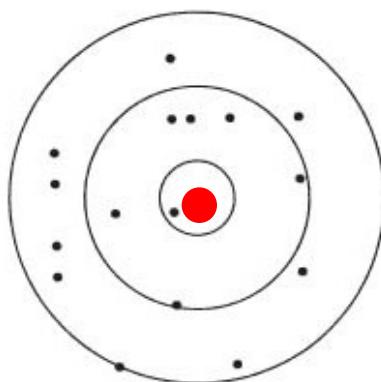
Again, we need to consider if our participants are WEIRD!
(Henrich *et al.* 2010)

Measures need to be both accurate (valid) and reliable

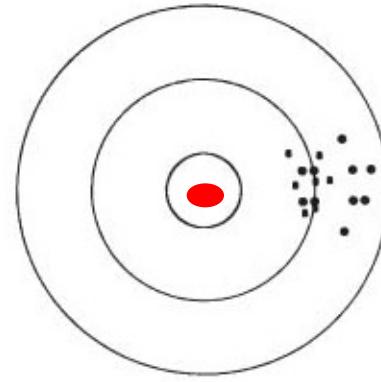
- Accuracy (validity)
- Reliability



Accurate and reliable



Neither accurate nor reliable



Reliable but not accurate

Validity

Issues in biopsychology

- **Continuity and stages**

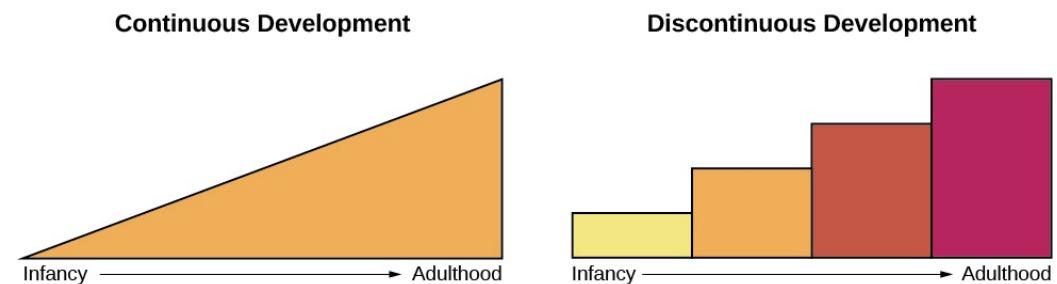
- Continuous vs. discrete

- **Stability and change**

- Stable vs. labile

- **Nature and nurture**

- Not *vs.*, but rather their interactions



Issues in biopsychology

Nature and Nurture

- **What's more important?** →
- **Poorly understood**
- **e.g. heritability estimate**
 - “the heritability estimate for IQ is 0.5”
 - Describes *variance*, not correlation



Issues in biopsychology

Nature and Nurture

- Are arms 0% genetic?

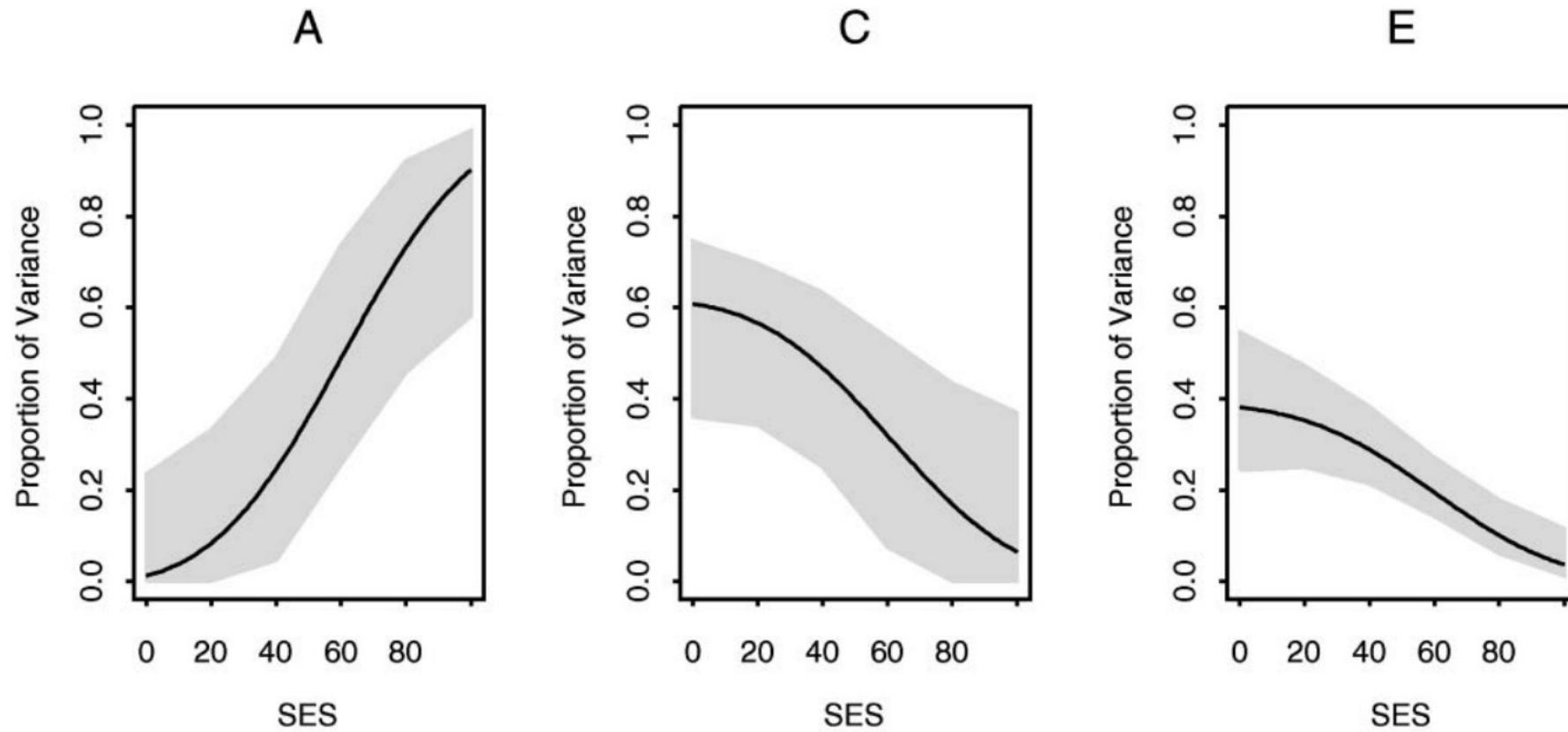


- OK, back to IQ...

Issues in biopsychology

Nature and Nurture

- Turkheimer *et al.* 2003



Issues in biopsychology

Nature and Nurture

• PLEASE MAKE IT STOP

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Published on September 25, 2018 — comments 211

Forget Nature Versus Nurture. Nature Has Won

written by Gregory Cochran



Issues in biopsychology

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Nathaniel Comfort questions a psychologist's troubling claims about genes and behaviour.

Nathaniel Comfort

PDF version



What should babies be screened for, and who should share in the data? Credit: BSIP/ UIG via Getty

Blueprint: How DNA Makes Us Who We Are Robert Plomin Allen Lane

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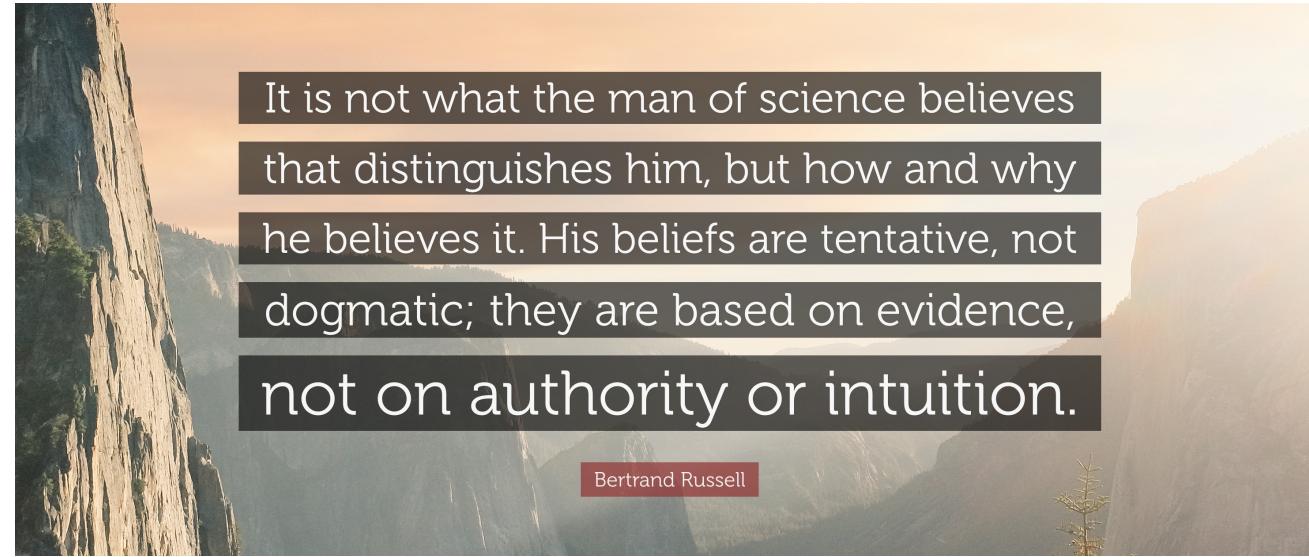
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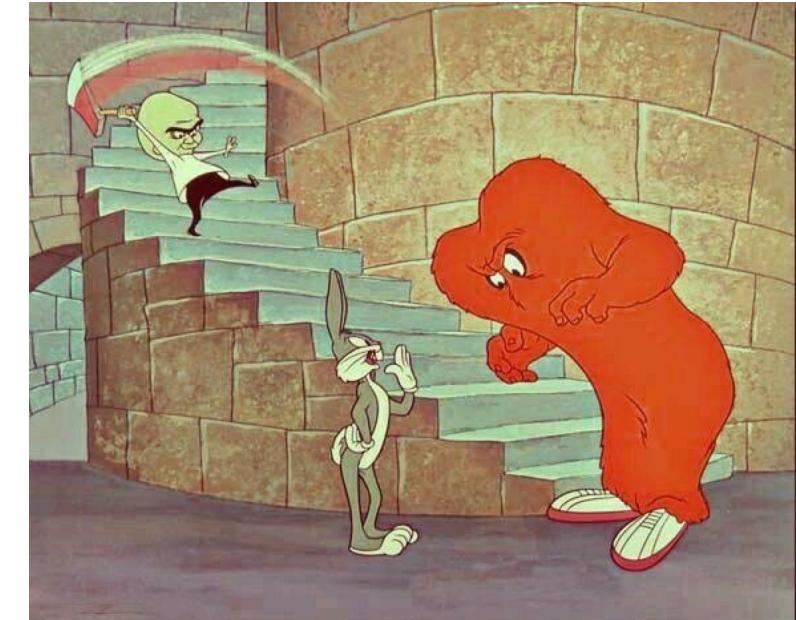
Science is not...

- A dogma (it's simply a method)
- Scientists (it's simply a method)
- Pharmaceutical companies (it's simply a method)
- Doctors (it's simply a method)



It is not what the man of science believes
that distinguishes him, but how and why
he believes it. His beliefs are tentative, not
dogmatic; they are based on evidence,
not on authority or intuition.

Bertrand Russell



Science is...

As good as it currently gets



- Science's history is full of questionable characters, but the scientific method remains our best way of acquiring information about the world
- Scientific models of the world may be incomplete, but they're certainly more accurate than any others
- Ignoring the best available evidence leads to tangible harm and misfortune
- Whether or not you believe in science, large institutions do and are using it



The scientific method