

Psyc 101, Pomerantz

Week 2

The Scientific Method: How to understand the mind and behavior

Vs. what? Casual observation, asking the experts, innate understanding, intuition

Elements of Scientific Method

- Specify the question/problem, in explicit language; use “taste”
- Observe events; collect replicable data using publicly observable methods; make the data as quantitative as possible. Note: some events are not easily replicated: Big Bang, patients with specific brain damage
- Form hypotheses (at least one) that could explain a relationship between two or more variables
- Test your hypotheses using new data (from experiments, when possible)
- Formulate a theory (an integrated set of principles; cf. ad hoc aphorisms, hunches)
- Test the theory by noting if it is consistent with the verified hypotheses. Falsifiability is desirable!
- If theory fails the test, tweak it or discard it.

Where is the scientific method used?

- All of science
- Medicine, for the most part
- Industry
- Marketing
- Casinos (yes, casinos)

Where does it tend not to be used?

- Religion
- Education (yes, education)
- Politics (but this is changing)
- Law (also changing)
- Casino patrons!

Experimental Research (cf. correlational research, below)

Experiments: controlled situations where variables are manipulated intentionally and independently

- Independent Variables (the elements that are manipulated)
- Dependent Variables (the elements that are measured)
- A simple experiment looks at the effect of one IV on one DV, e.g., the effect of increasing reward on speed of learning; the effect of salesperson’s smiling frequency on sales volume; the effect of talk psychotherapy on depression; the effect of wealth on happiness; etc.
- More complex experiments involve two or more IVs and DVs

- Relationships between IV and DV can be: linear or curvilinear, positive or negative, nonexistent.
- Confounds: arise when two or more IVs are correlated and thus need to be teased apart to determine which one(s) affect the DVs
- Control groups: the main way to eliminate confounds.
- Another method: repeated measures on same people (counterbalanced for testing order, etc.)
- Multiple IVs: look for additivity vs. interactions*
- Quasi-experiments: used when real experiments are not feasible (e.g., a forward looking study of relationship between diet and disease). Measure lots of variables so they can be controlled for statistically after the fact as much as possible (never perfect).

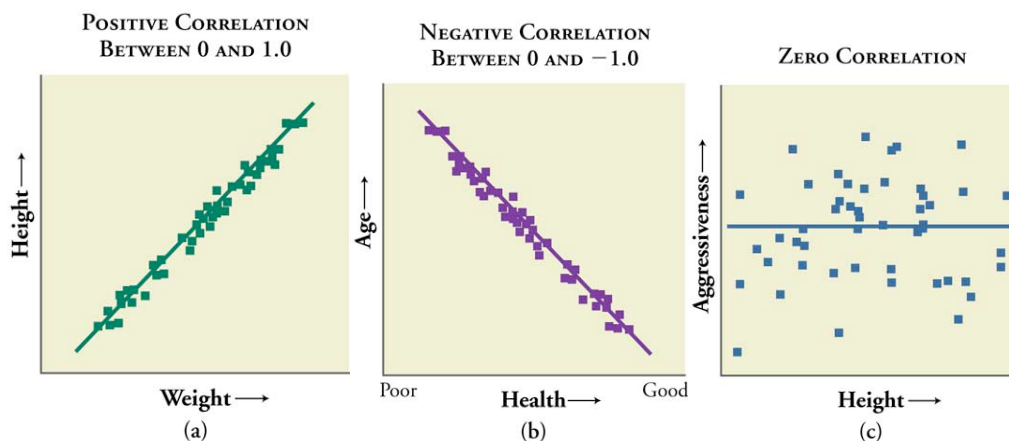
*Interactions arise when two or more IVs have effects that are non-additive; the effect of one depends on the others.

Correlational Research

When experiments are not possible or practical

E.g., handedness and longevity, where you cannot assign handedness randomly (just as you cannot assign gender, eye color, etc.)

Correlation: a statistical relationship in which changes in one variable are paralleled by changes in another.



Strength of correlational studies: you can study variables you cannot manipulate
 Weakness: you cannot infer what causes what. E.g., do cigarettes cause cancer?

Descriptive Research

Naturalistic observations

Case studies with small n's: limited experiments are possible here, as with savants, people with extraordinary capabilities (I.M.L. Hunter, mental calculator)

Surveys (the plural of anecdote is data)

Evaluating the quality of research

Direct measurement: desirable but difficult (e.g., time)

Reliability (consistency) of measurements: repeatability

Validity of measurements: accuracy. Constant vs. random error (clock example)

- Face validity: design and method seem to assess the variable of interest
- Content validity: the measure assesses all aspects of the variable
- Criterion validity: the measure or method is comparable to a different and previously validated measure or method
- Construct validity: measures assess variables specified by a theory

Bias

- Response bias
- Sampling bias
- Double blind method
- Confirmation bias (e.g., arithmetic errors)

Clever Hans effect: http://en.wikipedia.org/wiki/Clever_Hans

Pygmalion effect: http://en.wikipedia.org/wiki/Pygmalion_effect

Unobtrusive measures: hidden cameras, wear on books or floor tiles, web or newspaper searches

Experimental expectancy effect, double blind methods
“Pseudopsychology”, CSICOP

Statistics

Great stats link: <http://www.ruf.rice.edu/~lane/rvls.html>

Descriptive statistics

- Frequency distributions
- Measures of central tendency: mean, mode, median, weighted means
- Measures of dispersion: range, variance, error bars
- Deviation scores (z scores, SAT scores)
- Skewness (lopsidedness or asymmetry)

Weighted means:	60	30	60	20	
	50	20	50	10	
	40	10	40		
			30		
Mean:	50	20	45	15	Moving one item lowered both means

Inferential statistics

Example question: are two means really different?

Generalizing from samples to populations: buckets vs teaspoons

Statistical significance, p levels, two types of error

Statistical significance vs. importance: effect size

Correlations

How to lie with statistics: non-zero origin, transformed scales (speed vs. time)

Research Reporting sequence

QALMRI method (question, alternatives, logic, method, results, inferences)

Additional material on measurement

- Measurements of memory strength: recall, recognition, relearning, priming
- Measurements of stereotyping/prejudice: asking people about themselves, asking people about others, implicit associations test (IAT, Greenwald and Banaji, <https://implicit.harvard.edu/implicit/>)
- Cf. measurement of temperature in physics. In 1701 people began using the Rømer scale, under which water boiled at 60 and froze at 7.5 degrees; zero was reserved for salted water. In 1724, Daniel Fahrenheit introduced a new scale under which 100 was the highest outdoor temperature reached with any regularity in Western Europe, and 0 the lowest. Problem: there was nothing special about the freezing point of water, 32F. In 1742, Anders Celsius introduced a new scale linked to the freezing point and boiling point of water but got it backwards (100=freezing, 0=boiling, so it measured cold rather than heat). This was fixed after the death of Celsius in 1744.