

Chapter 2: Research Methods and Statistics In I/O Psychology

PSYC 301

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What Is Science?

- Approach that involves the understanding, prediction, and control of some phenomenon of interest
- A set of methods used to
 - Collect information about phenomena in an area
 - Build a reliable base of information in an area
 - Develop theories to explain phenomena

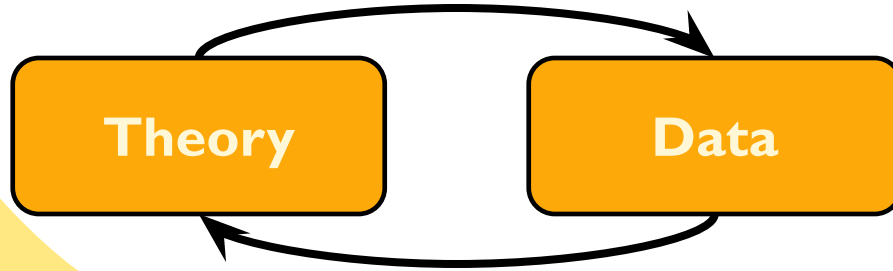
OVERVIEW OF RESEARCH IN IO

- Three purposes...
 - **Description**
 - **Explanation**
 - **Prediction**
- ...all rooted in **Theory**...
- ...confirmed and built upon by **Data**



OVERVIEW OF RESEARCH IN IO

- The cycle of research



Scientific Method: Four Steps

**OBSERVING A
PHENOMENON**



**Formulating
Tentative
Explanations**



**Further Observing
& Experimenting**



**Refining &
Retesting
Explanations**



Characteristics of Scientific Explanations

Scientific explanations are EMPIRICAL – They are based on objective, systematic observations

Scientific explanations are RATIONAL – They follow the rules of logic and are consistent with known facts

Scientific explanations are TESTABLE – They are verifiable through observation and can be disproved

Scientific explanations are PARSIMONIOUS – They provide the simplest explanation using the fewest possible assumptions

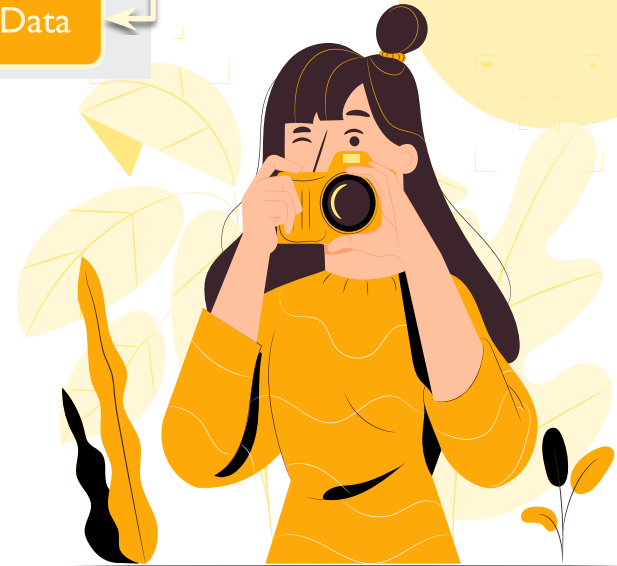
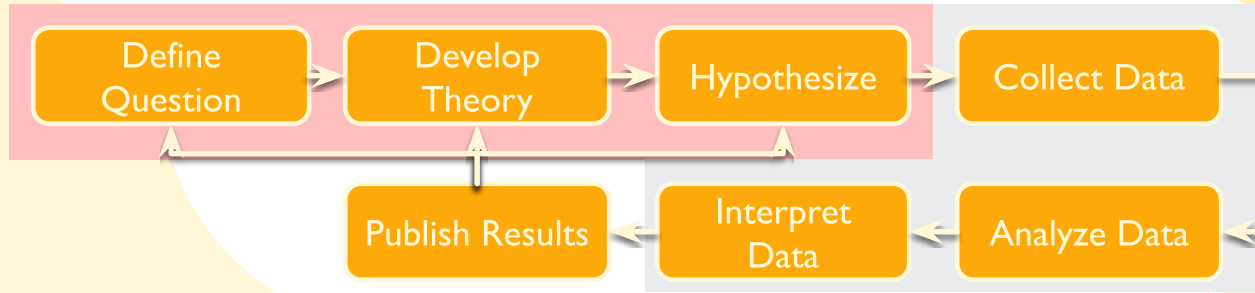
Scientific explanations are GENERAL – They apply beyond the original observations on which they are based

Scientific explanations are TENTATIVE – They are never accepted as absolutely correct

Scientific explanations are RIGOROUSLY EVALUATED – They are constantly evaluated for consistency with evidence, generality, and parsimony



THE RESEARCH PROCESS

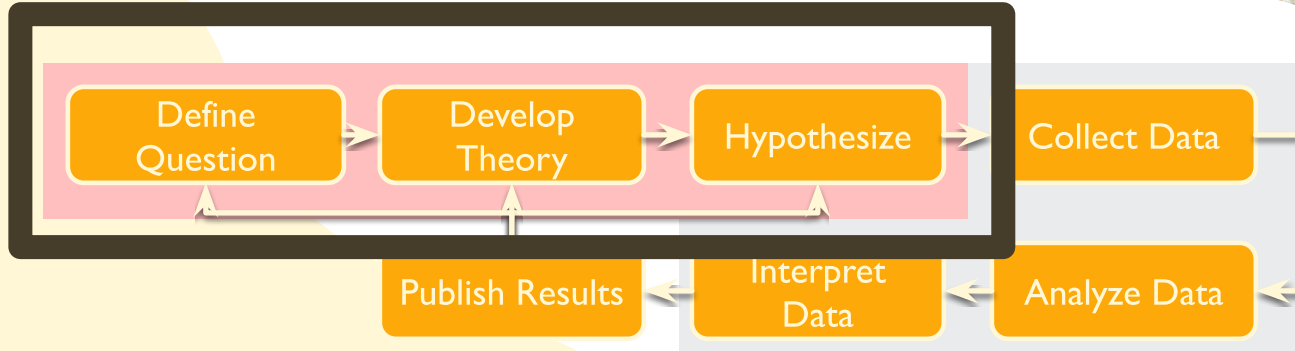


**Let's apply the
scientific
method to a
workplace
problem**



DISCUSSION

Come up with a question, theory and hypothesis related to what you saw.



SOME POTENTIAL QUESTIONS

Question: Are abusive bosses related to an employee's intention to leave an organization?

Theory: Abusive bosses make employees feel unsupported and unsafe at work.

Hypothesis: If an employee has an abusive boss, then they will be more likely to want to leave an organization.

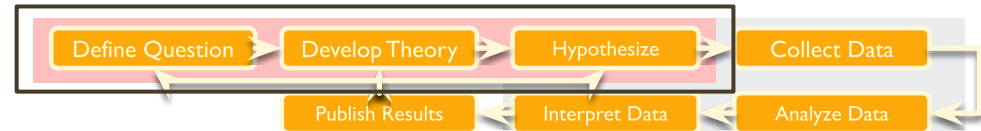
Question: What is one way that an employee can restore justice when confronted with an abusive boss?

Theory: Retaliation is one way that employees can restore justice.

Hypothesis: If an employee symbolically retaliates against their supervisor, the negative impact of abusive supervision on subordinate justice perceptions will be alleviated.



Let's talk about ways we might test our hypotheses...



RESEARCH DESIGN

- Experimental Designs

- Random assignment of participants to conditions
- Between-subjects, within-subjects, or single subject designs
- Can be conducted in lab or field setting

- Quasi-Experimental Designs

- Nonrandom assignment of participants to conditions
- Quasi-independent variable (e.g., gender)
- Can be conducted in lab or field setting



RESEARCH DESIGN

- Nonexperimental Designs
 - No unique conditions for participants
 - Observational or correlational designs
 - Generally conducted in the field



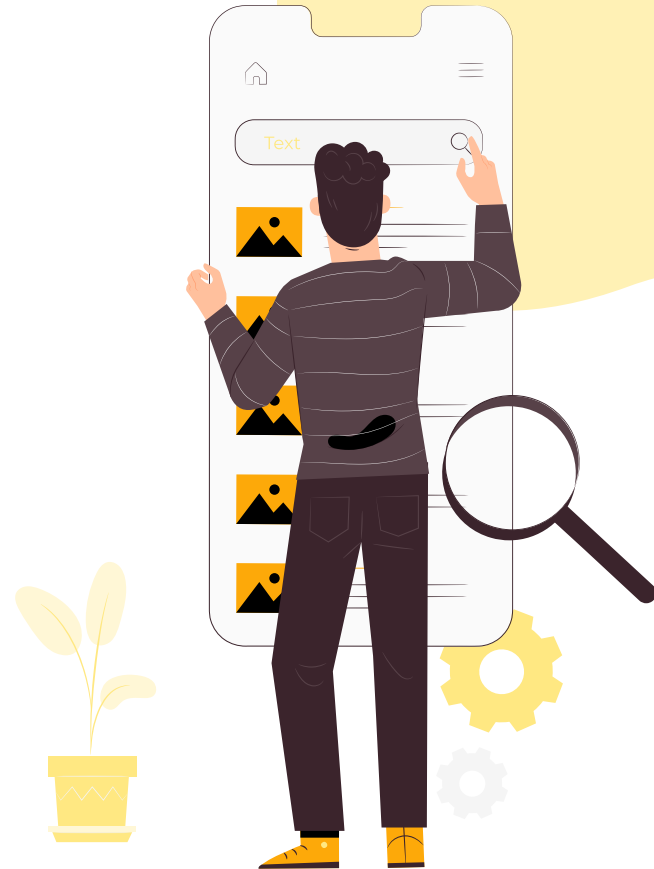
RESEARCH DESIGN CONTINUED

	Laboratory Experiment	Quasi-Experiment	Questionnaire	Observation
Control (potential for testing causal relationships)	High	Moderate	Low	Low
Realism (naturalness of setting)	Low	High	Moderate	High



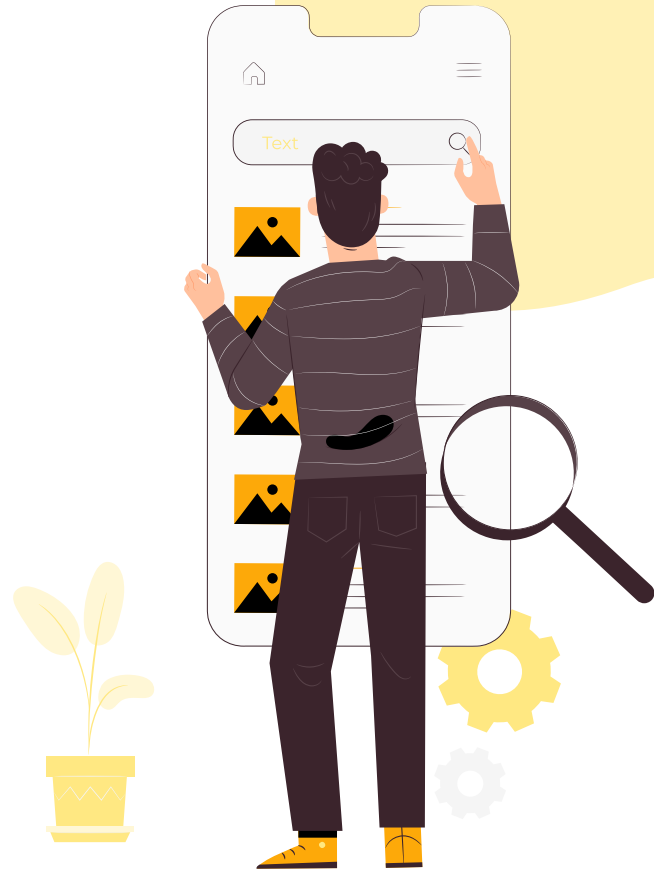
METHODS OF DATA COLLECTION

- Quantitative
 - Rely on tests, rating scales, questionnaires, and physiological measures
 - Yield numerical results
- Qualitative
 - Include procedures like observation, interview, case study, & analysis of written documents
 - Generally produce flow diagrams & narrative descriptions of events/processes
 - Can be converted to numerical results



METHODS OF DATA COLLECTION

- Quantitative vs. Qualitative – not mutually exclusive
- Triangulation...
 - Data provided from multiple sources
 - Use of quantitative and qualitative data



GENERALIZABILITY & CONTROL

- **Generalize** – apply results from one study/sample to other participants or situations
- Every time a compromise is made, the generalizability of results is reduced
- **Population:** the entire set of people or objects we want to study and to which we wish to generalize the findings
- **Sample:** subgroup of the population that is used to infer about the characteristics of the population



SAMPLING DOMAINS FOR I-O RESEARCH

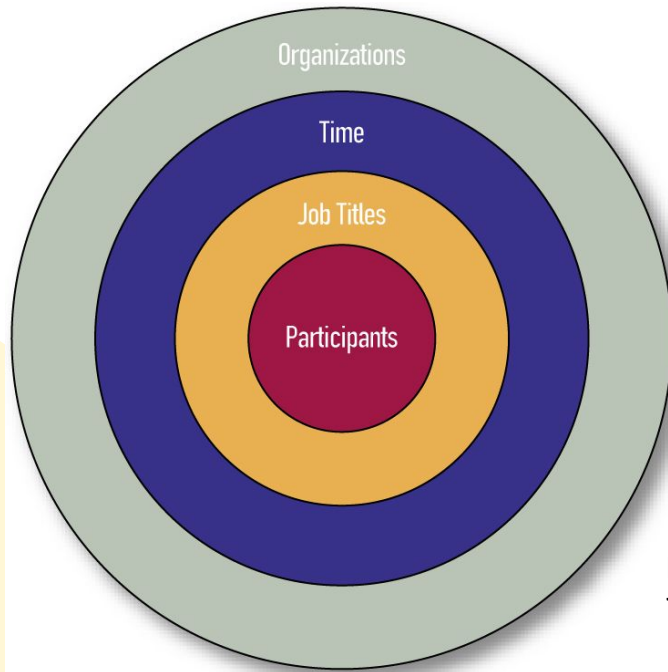


Figure 2.1: Sampling Domains
for I-O Research

GENERALIZABILITY & CONTROL

- **Experimental Control**: research design eliminates influences that could make results less reliable or harder to interpret
- **Statistical Control**: statistical techniques used to control for the influence of certain variables
- Experimental control trumps statistical control



Let's Revist Our Research Question

Question: What is one way that an employee can restore justice when confronted with an abusive boss?

Theory: Retaliation is one way that employees can restore justice.

Hypothesis: If an employee symbolically retaliates against their supervisor, the negative impact of abusive supervision on subordinate justice perceptions will be alleviated.

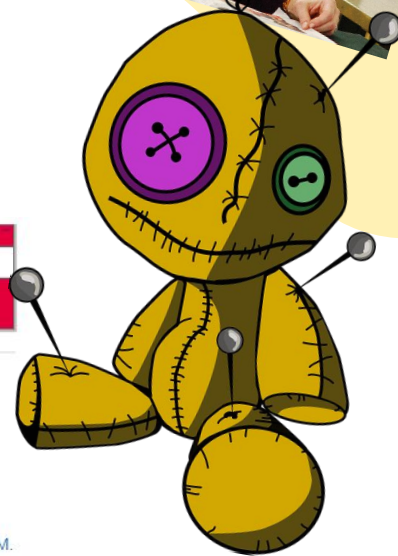


The Leadership Quarterly
Volume 29, Issue 4, August 2018, Pages 443-456

Righting a wrong: Retaliation on a voodoo doll symbolizing an abusive supervisor restores justice ☆

Lindie H. Liang ^a, Douglas J. Brown ^b, Huiwen Lian ^c, Samuel Hanig ^b, D. Lance Ferris ^d, Lisa M. Keeping ^a

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A Closer Look at Liang et al. (2018)



The Leadership Quarterly
Volume 29, Issue 4, August 2018, Pages 443-456

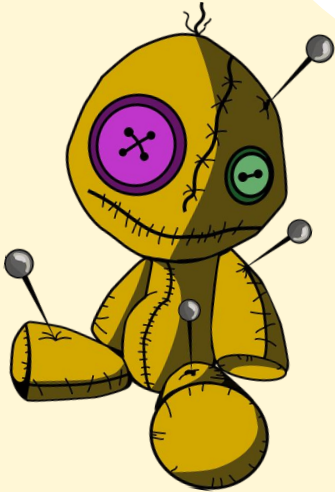


Righting a wrong: Retaliation on a voodoo doll symbolizing an abusive supervisor restores justice ☆

Indie H. Liang ^a✉, Douglas J. Brown ^b, Huiwen Lian ^c, Samuel Hanig ^b, D. Lance Ferris ^d, Lisa M. ...
...ping ^a

more ▾

- Subjects **randomly assigned** into **three conditions**: abusive supervision/no retaliation, abusive supervision/retaliation, and a control condition
- Participants were first asked to recall and visualize a workplace interaction, which was used to induce abusive supervision. Following this task, participants were asked to work on another task that involved the use of an online voodoo doll for 1 min, which we used to manipulate retaliation against the supervisor
- What do you think the results were?



ETHICAL BEHAVIOR IN I-O PSYCHOLOGY

- Ethical standards of the APA
 - “Do No Harm”
- SIOP book of 61 cases (Lowman, 1998)
 - Cases illustrate ethical issues that are likely to arise in I-O psychology
- Joel Lefkowitz (2003) published a book on values and ethics in I-O psychology



End of Chp. 2 Part 1

Do you have any questions?



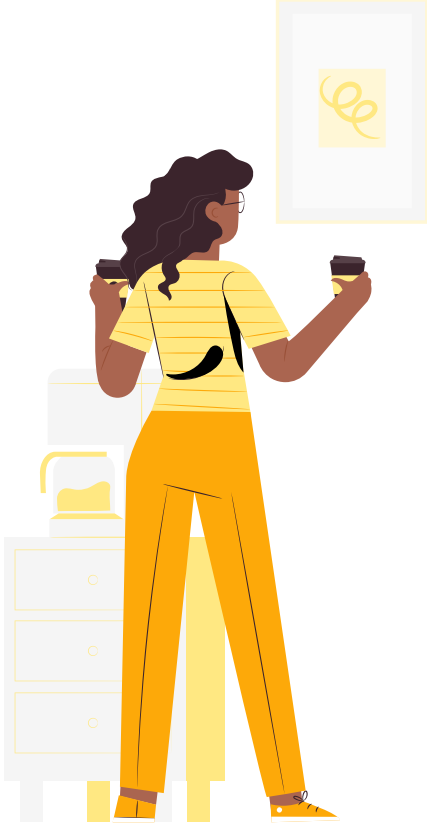
mstandis@hawk.iit.edu



1 Packback Question and 2 Responses
Due Tomorrow



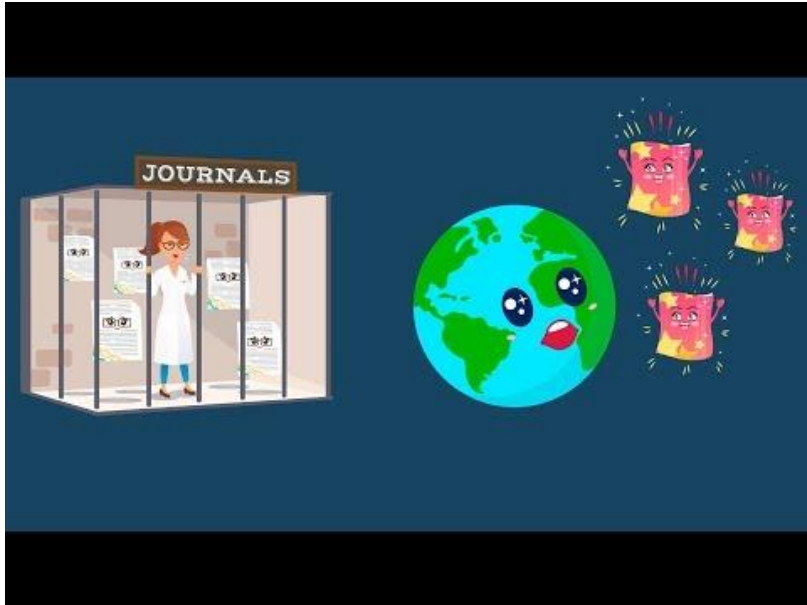
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Packback Question(s) Highlight!

1. Open Source Research in IO Psychology - Advisable?
2. Can I/O psychologists do anything to prevent people from generalizing their results incorrectly?
3. Could IO Psychology be effectively translated into schools and universities?

Packback Question(s) Highlight!



Open Source Research in IO

Psychology - Advisable?

Question from Adam Patton

Packback Question(s) Highlight!

When you tell me your employees are lazy instead of finding out why their performance has dropped



Meme from @iopsychmemes

Can I/O psychologists do anything to prevent people from generalizing their results incorrectly?

Question from Kacper Malysa

Packback Question(s) Highlight!



Could IO Psychology be effectively translated into schools and universities?

Question from Christopher Murray



Practice Quiz!



Data Analysis

- **Descriptive statistics:**
summarize, organize,
“describe” sample of data
 - Frequency Distribution:
 - Horizontal axis = Scores running low to high
 - Vertical axis = Indicates frequency of occurrence
 - Measures of central tendency
 - Variability
 - Skew

MEASURES OF CENTRAL TENDENCY

- Mode (most common score)

- 1 2 6 6 7 9 11

Mode = 6

- Mean (the average)

- 1 2 3 4 5 6
- 1 2 3 4 5 2000

Mean = 3.5

Mean = 335.8

- Median (the midpoint)

- 1 2 4 6 7 9 11
- 1 2 6 7 9 11
- 1 2 3 4 5 2000

Median = 6

Median = 6.5

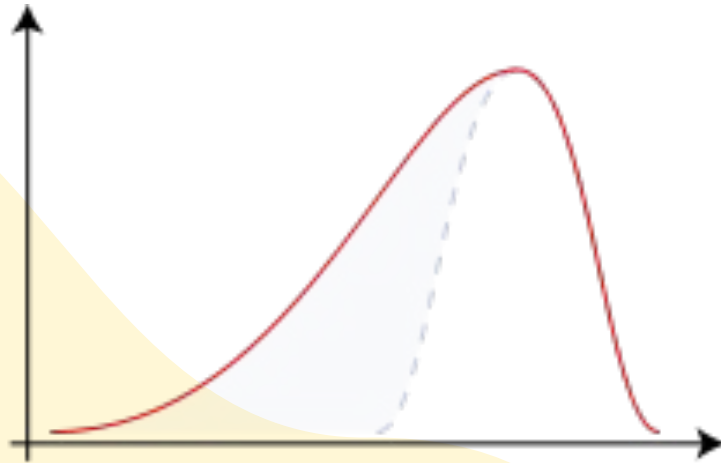
Median = 3.5



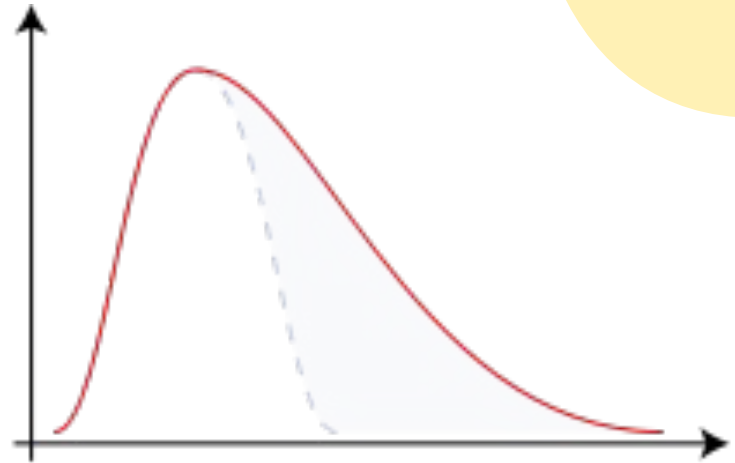
MEASURES OF VARIABILITY & SKEW

- Standard deviation
 - Describes the dispersion of data on either side of a mean value
 - The typical amount that each score varies, or “deviates”, from the mean
- Lopsidedness or skew

SKEWNESS



Negative Skew



Positive Skew

TWO SCORE DISTRIBUTIONS (N = 30)

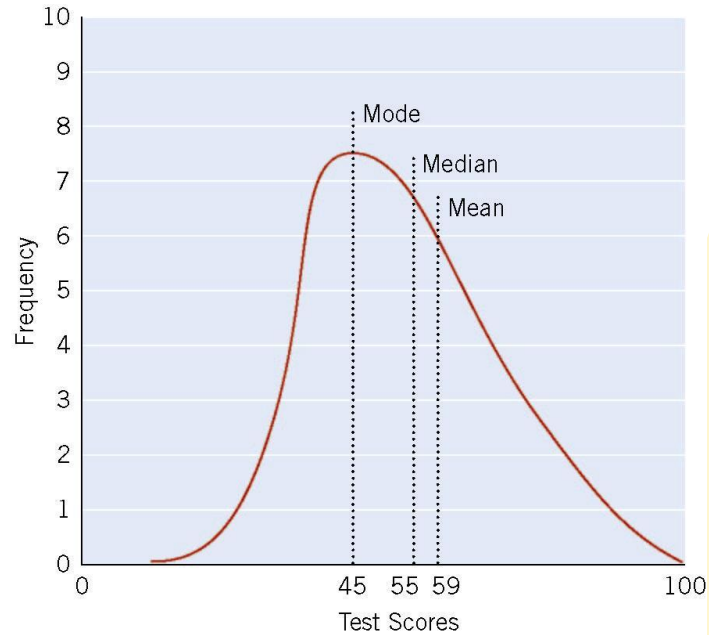
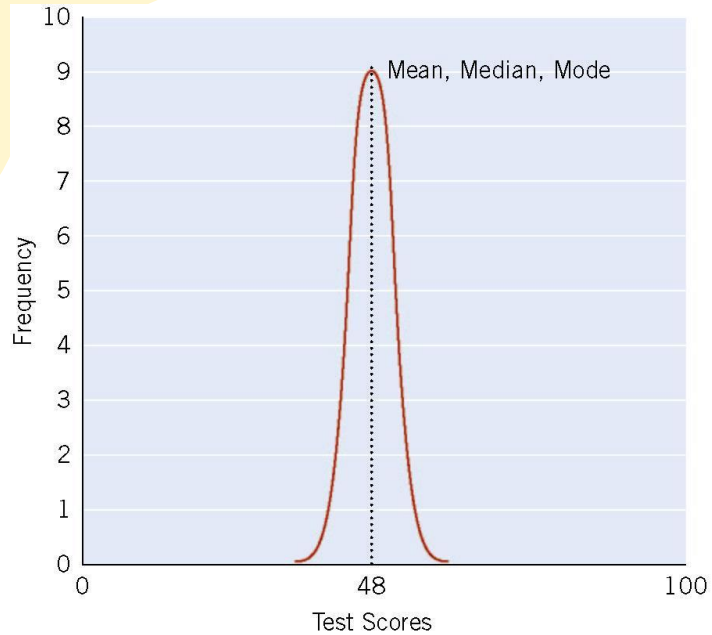


Figure 2.2 Two Score Distribution
(N=30)

INFERENCEAL STATISTICS

- Aid in testing hypotheses & making inferences from sample data to a larger sample/population
- Examples include t-test, F-test, chi-square test

STATISTICAL SIGNIFICANCE & POWER

Statistical Significance

- Defined in terms of a probability statement
- Threshold for significance is often set at .05 or lower
 - Finding significant at the 5% level
 - i.e., a difference that large would be expected to occur only 5 times out of 100 as a result of chance alone

Statistical Power

- Likelihood of finding statistically significant difference when true difference exists
- Smaller sample size $\square$ lower power

PEARSON'S PRODUCT-MOMENT CORRELATION COEFFICIENT

- Index of **linear** relationship between variables
- Ranges from -1 to +1
- Sign indicates direction of relationship
- Number indicates magnitude of relationship

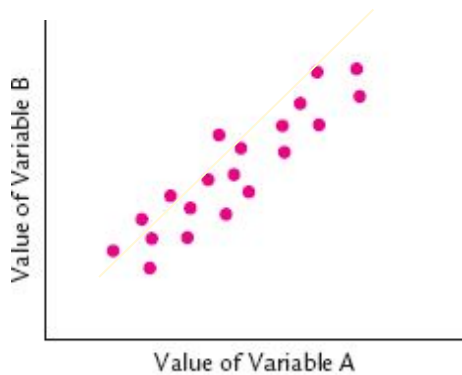


Poll

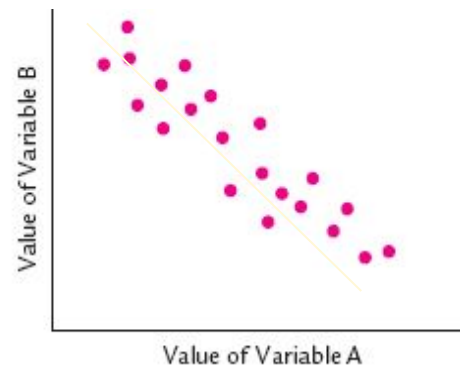
Which of the following is the strongest relationship?

- **-0.20**
- **0.00**
- **0.50**
- **-0.80**

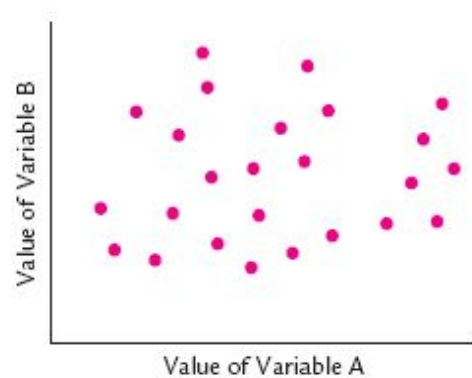
CORRELATION



(a)



(b)



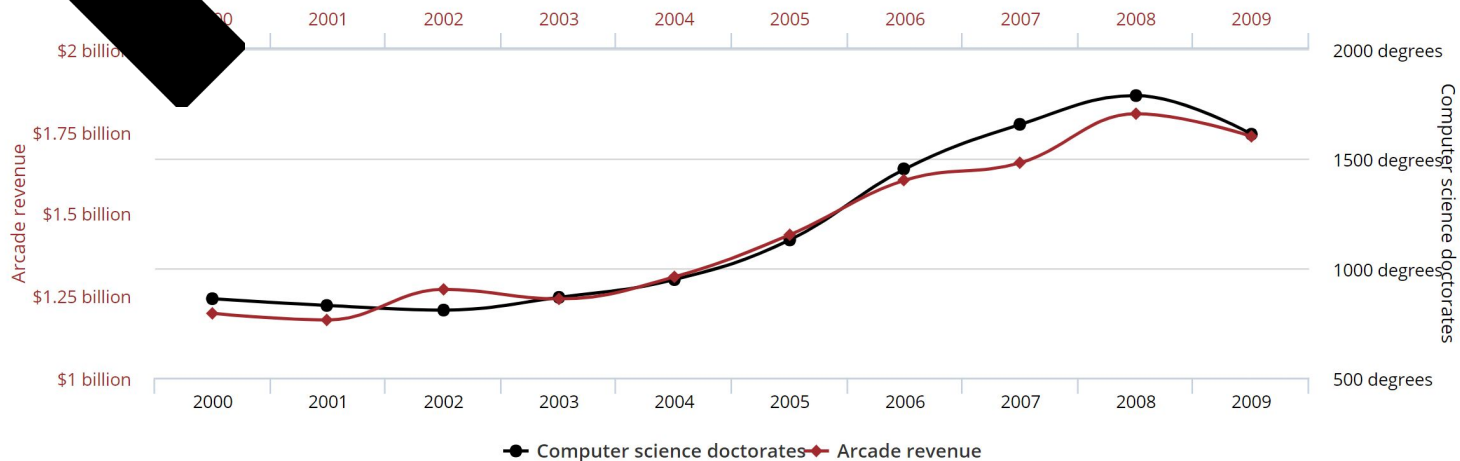
(c)

A CLOSER LOOK_
At spurious
correlations

**A CLOSER
LOOK
At spurious
correlations**

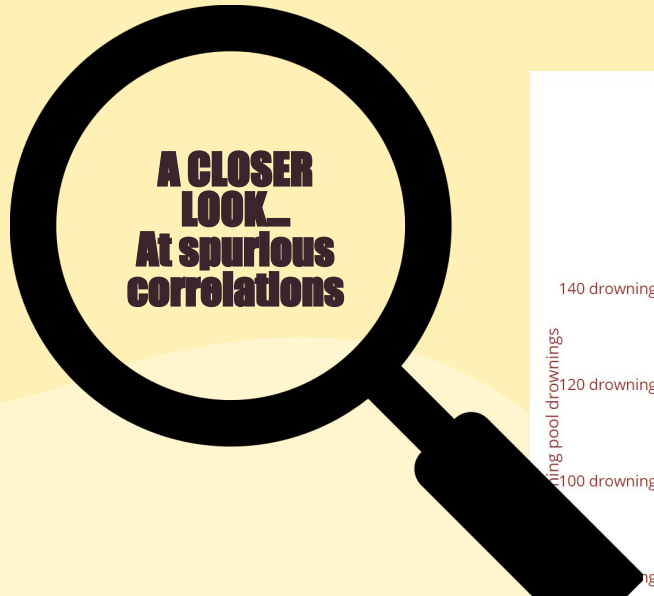
Total revenue generated by arcades
correlates with
Computer science doctorates awarded in the US

Correlation: 98.51% ($r=0.985065$)



Data sources: U.S. Census Bureau and National Science Foundation

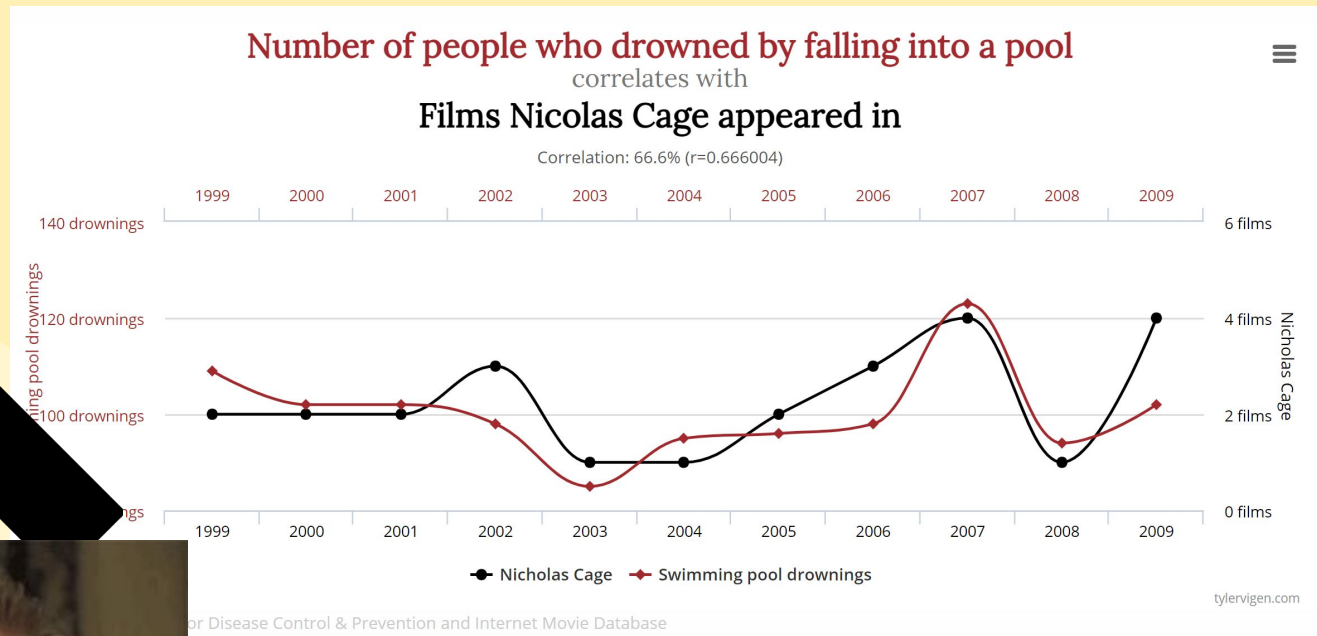
tylervigen.com



**A CLOSER
LOOK
At spurious
correlations**



YOU DON'T SAY?



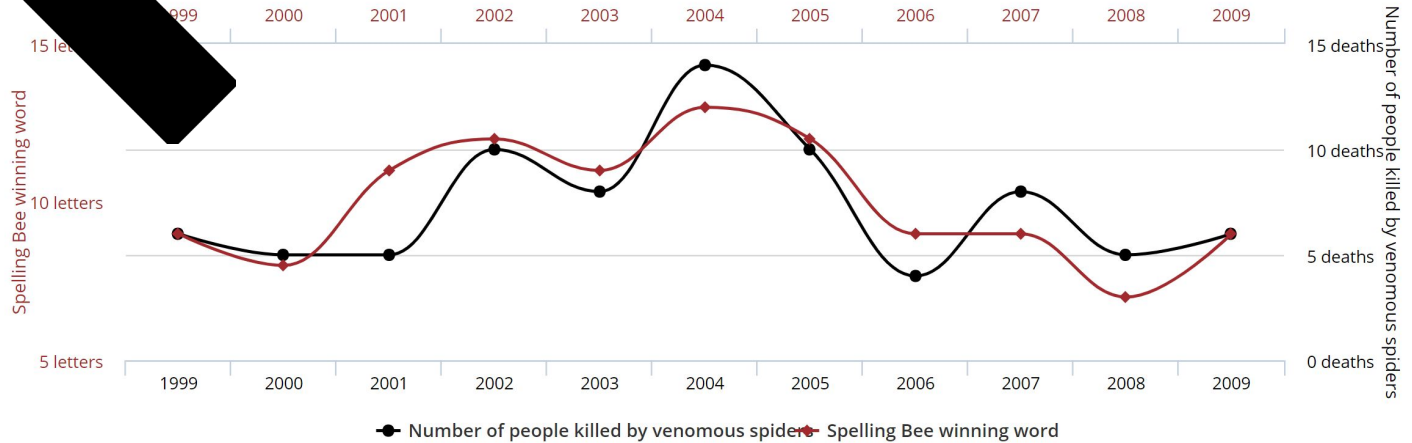
**A CLOSER
LOOK
At spurious
correlations**

Letters in Winning Word of Scripps National Spelling Bee

correlates with

Number of people killed by venomous spiders

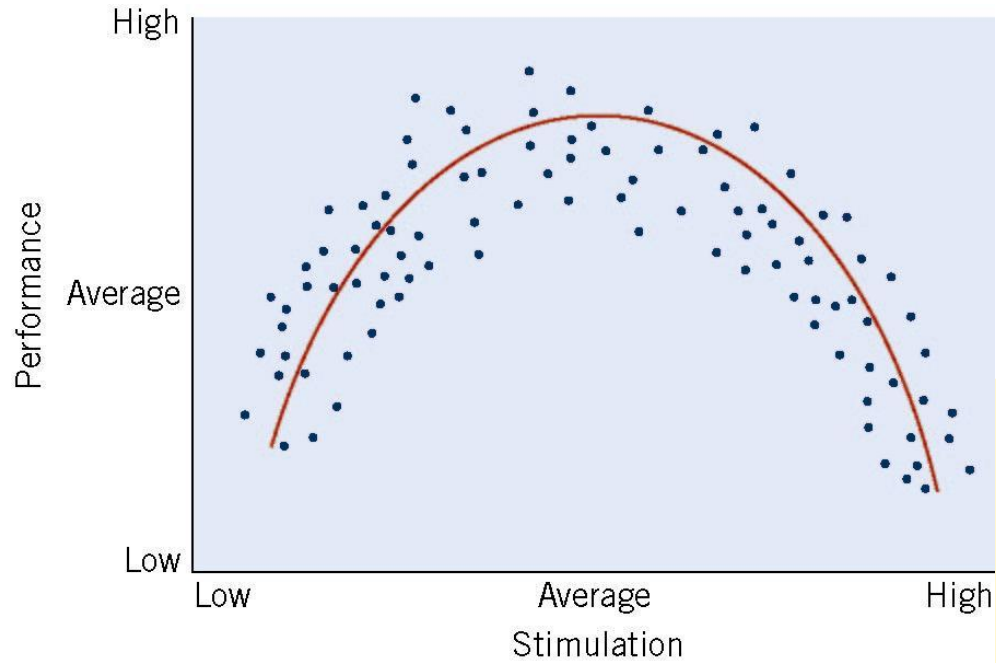
Correlation: 80.57% ($r=0.8057$)



Data sources: National Spelling Bee and Centers for Disease Control & Prevention

tylervigen.com

CURVILINEAR CORRELATION



REGRESSION

Regression

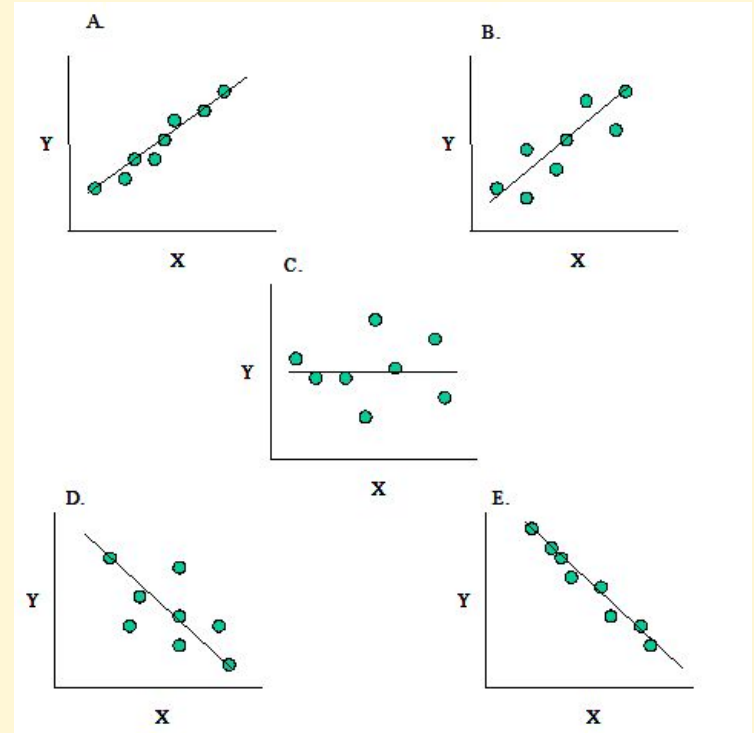
Line of “best fit”

Used for prediction of a criterion (DV) from a predictor (IV)

Multiple Regression

Allows for many predictors simultaneously

Multiple correlation coefficient, R



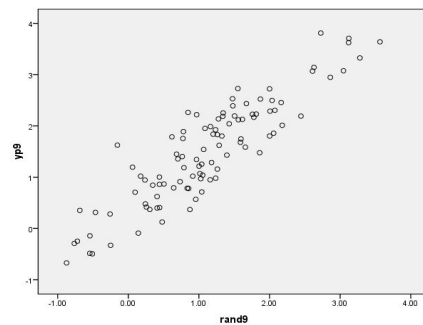
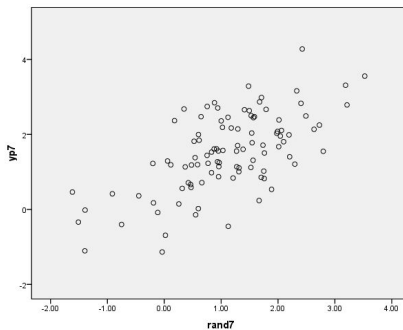
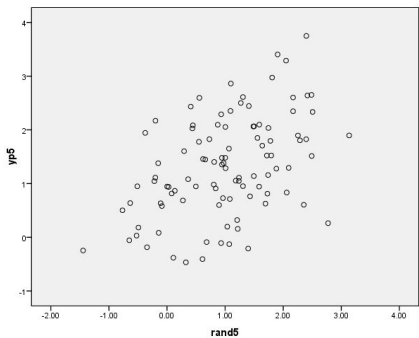
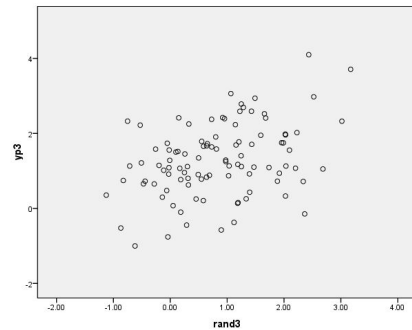
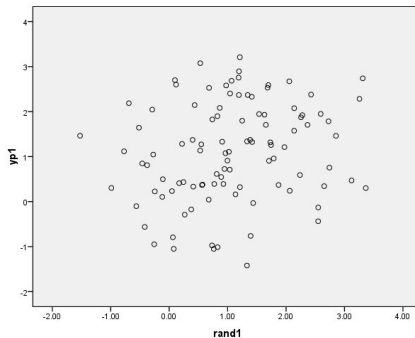
META-ANALYSIS

- Aggregation of multiple studies of the same underlying relationship
- Example: Job Performance vs. Job Satisfaction

N of studies	N of people	Estimated ρ
312	54,471	.30

WHAT IS THE RELATIONSHIP BETWEEN JOB PERFORMANCE AND JOB SATISFACTION?

1. $r = 0.10$
2. $r = 0.30$
3. $r = 0.50$
4. $r = 0.70$
5. $r = 0.90$





Interpretation through Reliability and Validity

RELIABILITY

- The RELIABILITY of a Measure
 - A reliable measure produces similar results when repeated measurements are made under identical conditions
 - Reliability is necessary but not sufficient for validity
 - Should be $> .70$

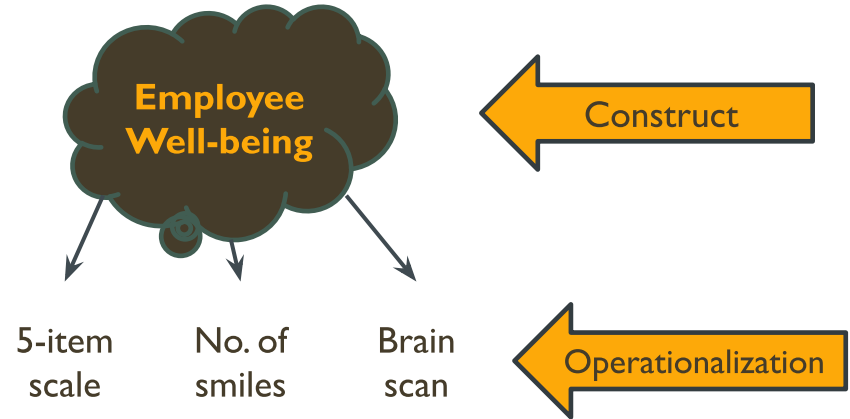


TYPES OF RELIABILITY

- Test-retest reliability: Administer the same test twice
- Equivalent forms reliability: Alternate forms of the same test used
- Internal Consistency
 - **Split-half reliability**: Parallel forms are included on one test and later separated for comparison
 - **Cronbach's alpha**: Average of all possible split-half reliabilities. Assesses how the items “hang together”
- Inter-Rater reliability: level of agreement among raters

VALIDITY

- The VALIDITY of a Measure
 - A valid measure measures what you intend it to measure
 - Validity is a unitary construct



METHODS OF ESTABLISHING VALIDITY

Content validity: How adequately does a test sample behavior it is intended to measure?

A measure has content validity if its items are relevant to construct being measured

METHODS OF ESTABLISHING VALIDITY

Construct validity: Do the results of a test correlate with what is theoretically known about the construct being evaluated?

Convergent validity: does the measure correlate with other theoretically similar measures

Discriminant validity: does the measure NOT correlate with other measures it theoretically should NOT be related to

METHODS OF ESTABLISHING VALIDITY

Criterion-related validity: How adequately does a test score match some criterion score?

Indexed by a **validity coefficient**

Takes two forms

Concurrent validity:

Test and criterion
measured at the same time

Do scores correlate?

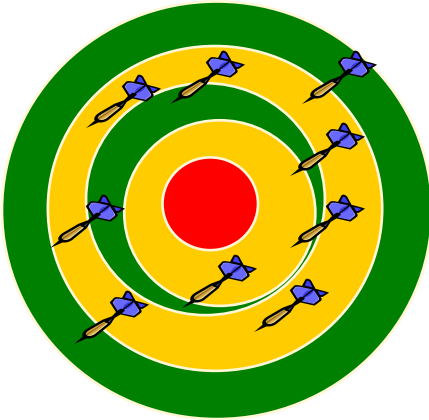
Predictive validity:

Time lag between test and
criterion measurement

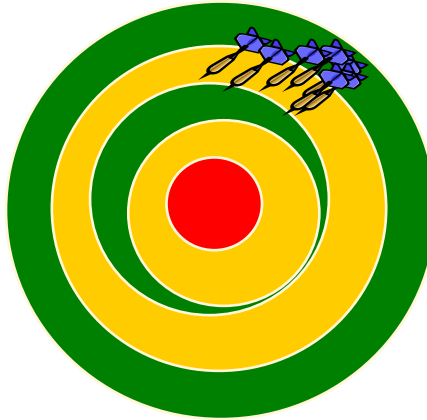
Does test predict the
criterion?

RELIABILITY VS. VALIDITY

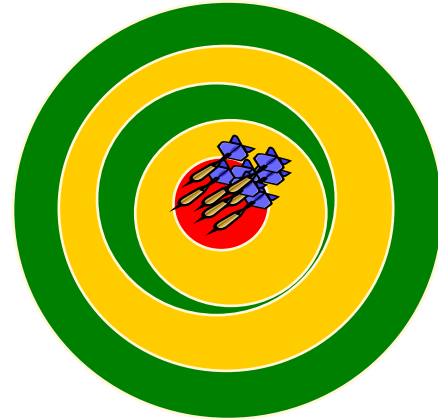
- A game of darts as metaphor for a test. The goal of darts is to hit the bullseye.



Not consistent or accurate



Consistent but not accurate



Consistent and accurate



RELATIONSHIPS BETWEEN VARIABLES

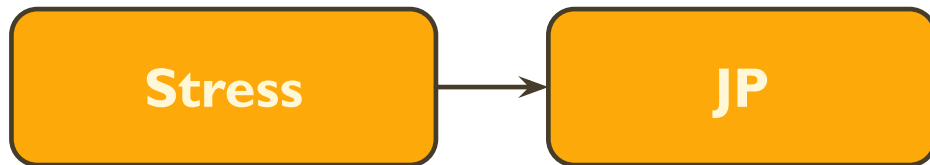
Direct (Causation)

Mediation

Moderation

RELATIONSHIPS BETWEEN VARIABLES

CAUSATION



MEDIATION



MODERATION



THANKS

Do you have any questions?



mstandis@hawk.iit.edu



Quiz should now be accessible on
blackboard!



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