

# **Week 8 Lecture - Bivariate Correlation**

Undergraduate Research Methods in Psychology

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## 1 Chapter Overview

## **1.1** Learning Objectives

- Explain that measured variables not any particular statistic make a study correlational.
- Interrogate the construct validity and statistical validity (and, of lower priority, external validity) of an association claim.
- Explain why a correlational study can support an association claim, but not a causal claim.
- Be able to understand the defining characteristics of a correlational, bivariate research design
- Be able to use appropriate vocabulary and logic used in describing and assessing bivariate designs

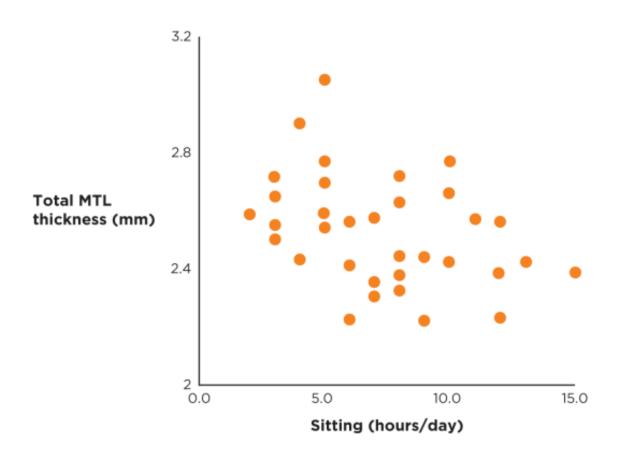
### 1.2 Chapter Overview

class, as it will often come back in these u	re you review vocab from the first half of pcoming lectures.
• "Bivariate" $ o$ means	variables _
ullet Two, <b>measured</b> variables $ o$ likely an	claim being made
• Review: Remember the vocabulary we shown a management of the second se	uld expect with associative claims between sociated with", "correlated with", etc.
Discuss: Any other examples of vocab nor	rmally used with associative claims?

are the most appropriate graphing method

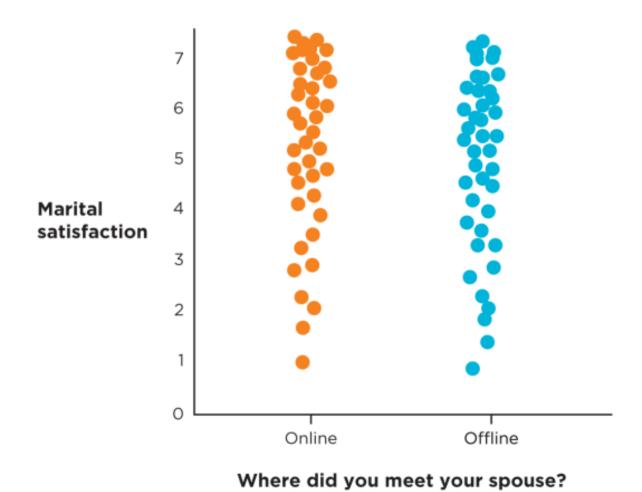
## 2 Bivariate Correlation

	Deviews Decall that there are three possible association /
•	Review: Recall that there are three possible association / descriptions between two variables:  - Positive - Negative
	– /no relationship
•	Also recall that these are descriptors for or straight-line relationships - we'll discuss how curvilinear relationships are a bit more complicated later today
2.2	Association Between Two Continuous Variables  Example:  - Two self-report measurements continuous outcome are strongly, positively con-
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	<ul> <li>Example:</li> <li>Two self-report measurements continuous outcome are strongly, positively correlated with one another</li> </ul>
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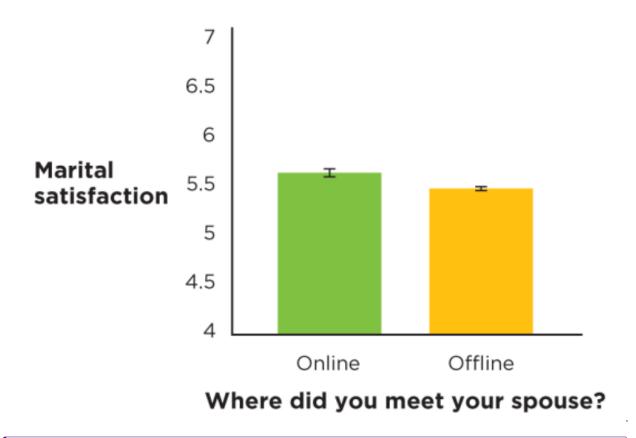
## 2.3 Association Between Categorical and Continuous Variables

- The prior example shows how to work with continuous variables, what about when we have one /discrete and one continuous variable?
- One option: A sort of scatterplot by the categorical variable



Discuss: What do you think is the direction and strength of relationship here?

- In most cases, we will probably prefer other \_\_\_\_\_\_ to graphical display information when we have categorical and continuous variables, as the split scatterplot can be somewhat confusing or difficult to interpret.
- Another option: A graph



Discuss: What do you all think those small, black bars mean? What sorts of helpful information could they tell us about differences between the groups?

## 2.4 Fully Correlation Design

- A \_\_\_\_\_\_ design is one that results from all relevant variables being measured, not based on what scale of measurement was used, statistic, or graph.
- The designs that we discuss are largely defined by whether variables are measured or manipulated *and* the \_\_\_\_\_\_ we hypothesize between the variables (i.e., what claim we are attempting to make)

## Critical Association Claims

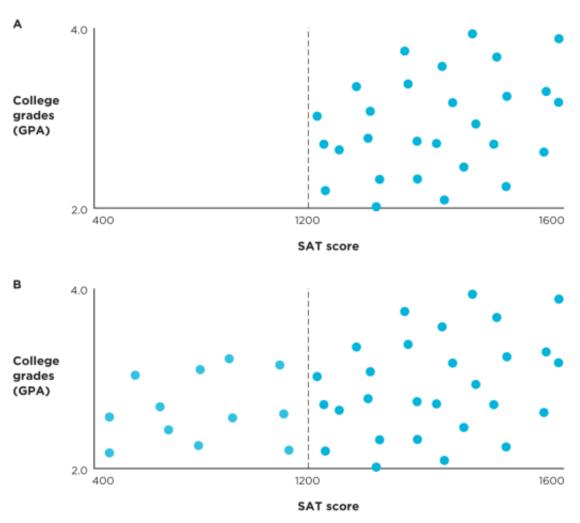
<b>3.</b> 1	L Co	nstruc	t Va	lidity
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• Review: construct validity is all about t	he reliability and validity
of the tools we use to measure a pher	
- 3 reliabilities: test-retest,	, and internal
- 5 validities: criminant	, content, criterion, convergent, divergent/dis- -
Use the terms and suggestions from a	chapters 5 and 6 to this!
	·
•	ny measures may not be measuring the same onable use of the word "not" in the item.
	tem not well correlated with other items of and what measurement validity type)? What oblem presented by 'not' in the question?
3.2 Statistical Validity	
Statistical validity has multiple comport	nents to be looking for:
	<u> </u>
3.2.1 Effect Size	
Effect size is all about the magnitude	of the results we found, it is not the same as
• Assessing $r$ correlation	effect
•	sciences: 0.10 (weak), 0.20 (moderate), 0.30
We may also use	_
- This refers to the amount of	that one variable accounts
for in another	

- Low effect size $ ightarrow$ possible	or non-meaningful effect
• High effect size $ ightarrow$ possible me	eaningful/effect
	ples x and y have an r = 0.50 and $r^2$ = 0.25 a very strong or powerful effect
3.2.2 Precision	
	do we call the intervals in which 95% of estimates will vals
• Common	: CI 95%:[Low-end Estimate, High-end Estimate]
• Larger sample size $ ightarrow$ usually	confidence intervals
• More precision = "better", more	estimate
estimate with	.30, I have CI 95%:[0.28, 0.32], this shows a precise confidence intervals
3.2.3 Replication	
• A question we should ask:	has this association been shown before in the
We may and see if we get a similar valu	the study and measurements again on a new group e
<ul> <li>Review: This is a good use analysis articles, as they can co ation. Remember, we are looki of a claim.</li> </ul>	mpile different studies investigating the same associ-
Discuss: What have you all h classes?	neard about replication in science in your other

## 3.2.4 Outliers

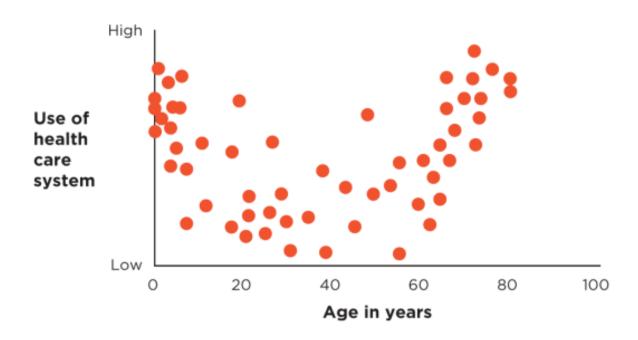
Discuss: Based on what you all know from prevof an outlier?	vious classes, what is the definition
An outlier, especially one the relationship of two variables.	on both variables, can greatly sway
However, we should not simply     inconvenient findings	out outliers because they are
<ul><li>inconvenient findings.</li><li>Instead, we may consider robust/non-pacture</li><li>can work around them as is</li></ul>	arametric that
<ul> <li>Depending on who you ask, any value 3 or 4 mean would be considered an outlier.</li> </ul>	standard deviations away from the
3.2.5 Restriction of Range	
<ul> <li>This is when we do not have points across the levels on one or both of our variables</li> </ul>	full number of



• Example: the possible scores on the test are 0 - 100, but all students only got between 70 and 85  $\rightarrow$  this is restriction of range problem.

#### 3.2.6 Curvilinear Relationships

 $\, \cdot \, r$  assumes a relationship between the two variables, but this is not true of all relationships in reality



#### 3.3 Internal Validity

• For association claims, we do not need to be concerned with meeting standards of internal validity, because a correlative design cannot explore relationships.

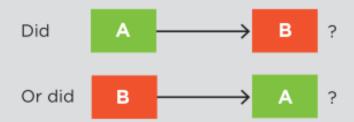
Discuss: What research design can investigate a causal relationship

- *Review:* What is the common phrase we use to describe the relationship between correlation and causation?
  - Correlation does not causation
  - Put simply, association alone does not tell us one "caused" the other!
- Review: What were the 3 causation criteria to establish a causal claim?
  - Covariance
  - Precedence directionality problem
  - Internal validity third-variable problem

1. Covariance: Do the results show that the variables are correlated?

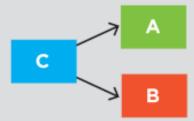


2. Temporal precedence (directionality problem): Does the method establish which variable came first in time?



(If we cannot tell which came first, we cannot infer causation.)

3. *Internal validity* (third-variable problem): Is there a C variable that is associated with both A and B, independently?



(If there is a plausible third variable, we cannot infer causation.)

- Example: I am measuring the relationship between exercise and feeling of self-worth, both as continuous
  - High, positive correlation between the two can I say exercise causes higher self-worth?
  - Say energy level is correlated with both exercise and feeling of self-worth, then what really is the cause?

_	What is the so-called <i>third-variable</i> here?	leve
_	What is the so-called <i>third-variable</i> here?	lev

### 3.4 External Validity

Discuss: What matters more for 'good', representative sampling: or methodology?	size of sample
Bad external validity does not necessarily limits its generalizability	a claim, but just
<ul> <li>Example: I use quota sampling to gather my participants, and relationship between the variables</li> </ul>	find an $r = 0.60$
- What direction and strength of relationship is this?	and
<u>.</u>	
- Is this a biased or unbiased sample?	! As it is non
probabilistic	
are some third variable that plays a partial re-	ole in the relation-
ship between two variable	
<ul> <li>These may result in a broader, more complicated theory are structs</li> </ul>	ound certain con-
<ul> <li>But most psychological constructs are complex!</li> </ul>	

## 4 Key Points

## **4.1** Key Points

- Bivariate, correlational designs are those that focus on the relationship between two measured variables, i.e., investigating an association claim
- Assessing a study using this design is a function of (mostly) external, statistical, and construct validity. Internal validity doesn't really apply, as we are missing the critical criteria necessary for a causal claim.

- We have several ways to graphically and statistically represent the relationship between two variables, but we also have several considerations such as effect size and precision of our estimate.
- We began to discuss some of the nuance in assessing internal validity, we'll return to this as we creep closer to experiments!