

An Introduction to Statistics

Types of Variables

Discrete

Variables that can only take on specific values

No other values can exist between these numbers (e.g., whole numbers)

- How many letters are in your name?

Continuous

Variables that can take on a full range of values

An infinite number of potential values exists

- How tall are you?

More Classification of Variables

Discrete observations

Nominal: Category or name

Ordinal: Used for observations that have data rankings

Continuous observations

Interval: Used with numbers that are equally spaced

Ratio: Like interval, but has a meaningful zero point

Scale	Defining Features	Example	Distinction
Nominal	Categories with no numeric scales	Males/females Experimental condition/ control condition	Impossible to define any quantitative values and/or differences between/ across categories
Ordinal	Rank ordering Numeric values have limited meaning	2-, 3-, and 4-star restaurants Birth order	Intervals between items not known or inconsistent
Interval	Numeric properties are literal Assume equal interval between values	Intelligence Temperature (Fahrenheit or Celsius)	No true zero
Ratio	Zero indicates absence of variable measured Assume equal interval between values	Reaction time Age Frequencies of behaviours	Can form ratios (e.g., someone responds twice as fast as another person)

Examples of Variables

Nominal: Name of cookies

Ordinal: Ranking of favorite cookies

Interval: Temperature of cookies

Ratio: How many cookies are left?

What kind of data does our Stroop test give us? Interval or ratio?

Quantifying Our Observations

- There are four types of variables that researchers can use to quantify their observations.
- Two of them, nominal and ordinal, are always discrete.

	Discrete	Continuous
Nominal	Always	Never
Ordinal	Always	Never
Interval	Sometimes	Sometimes
Ratio	Seldom	Almost Always

Quantifying Our Observations

- **There are four types of variables that researchers can use to quantify their observations.**
- **Interval variables can be discrete or continuous**

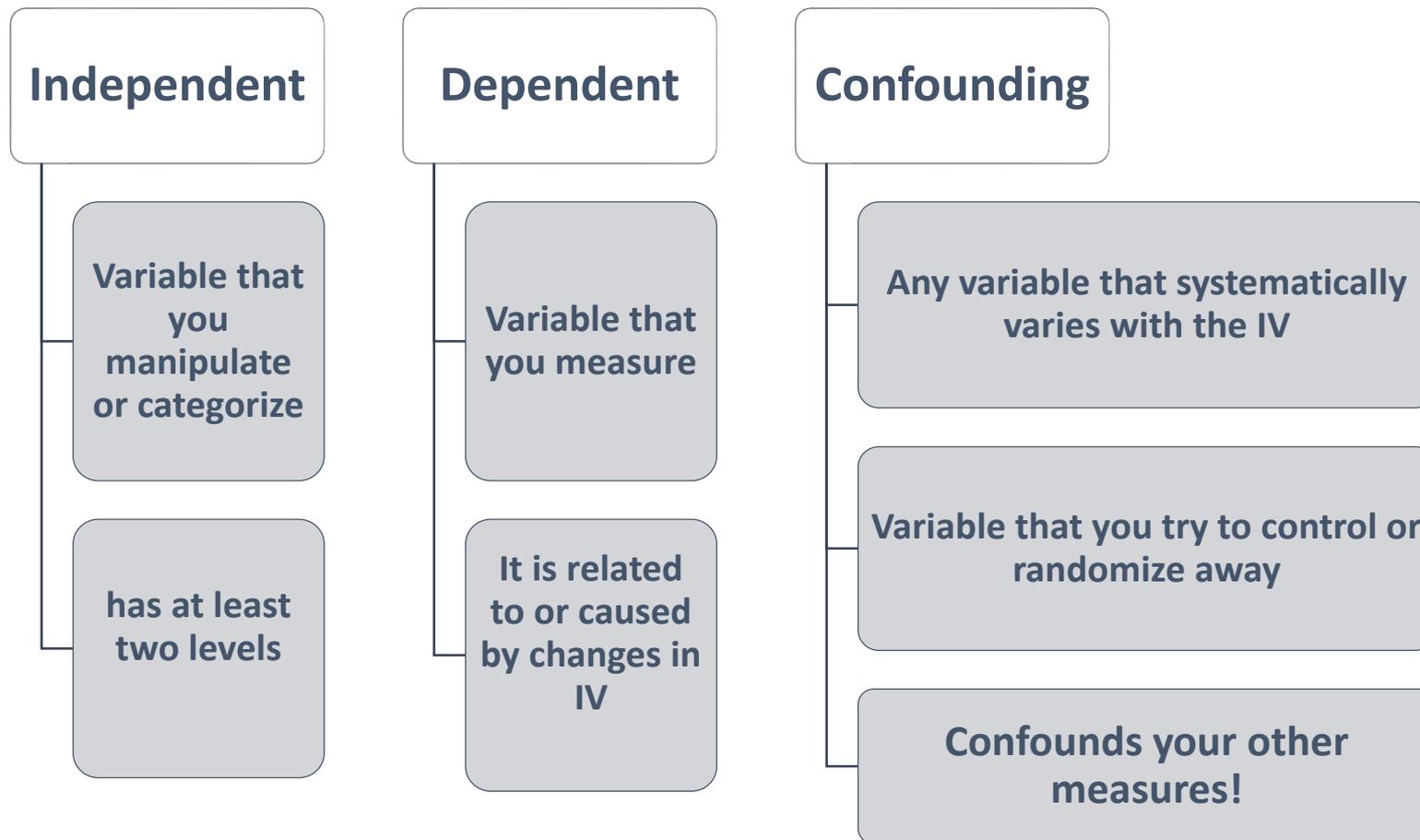
	Discrete	Continuous
Nominal	Always	Never
Ordinal	Always	Never
Interval	Sometimes	Sometimes
Ratio	Seldom	Almost Always

Quantifying Our Observations

- **There are four types of variables that researchers can use to quantify their observations.**
- **ratio variables are almost always continuous. (Interval variables and ratio variables are often referred to as “scale variables”)**

	Discrete	Continuous
Nominal	Always	Never
Ordinal	Always	Never
Interval	Sometimes	Sometimes
Ratio	Seldom	Almost Always

Variables and Research



Reliability and Validity

A **reliable measure** is consistent.

Measure your height today and then again tomorrow.

A **valid measure** is one that measures what it was intended to measure.

A measuring tape should accurately measure height.

A good variable is **both** reliable and valid.

Rorschach Personality Test

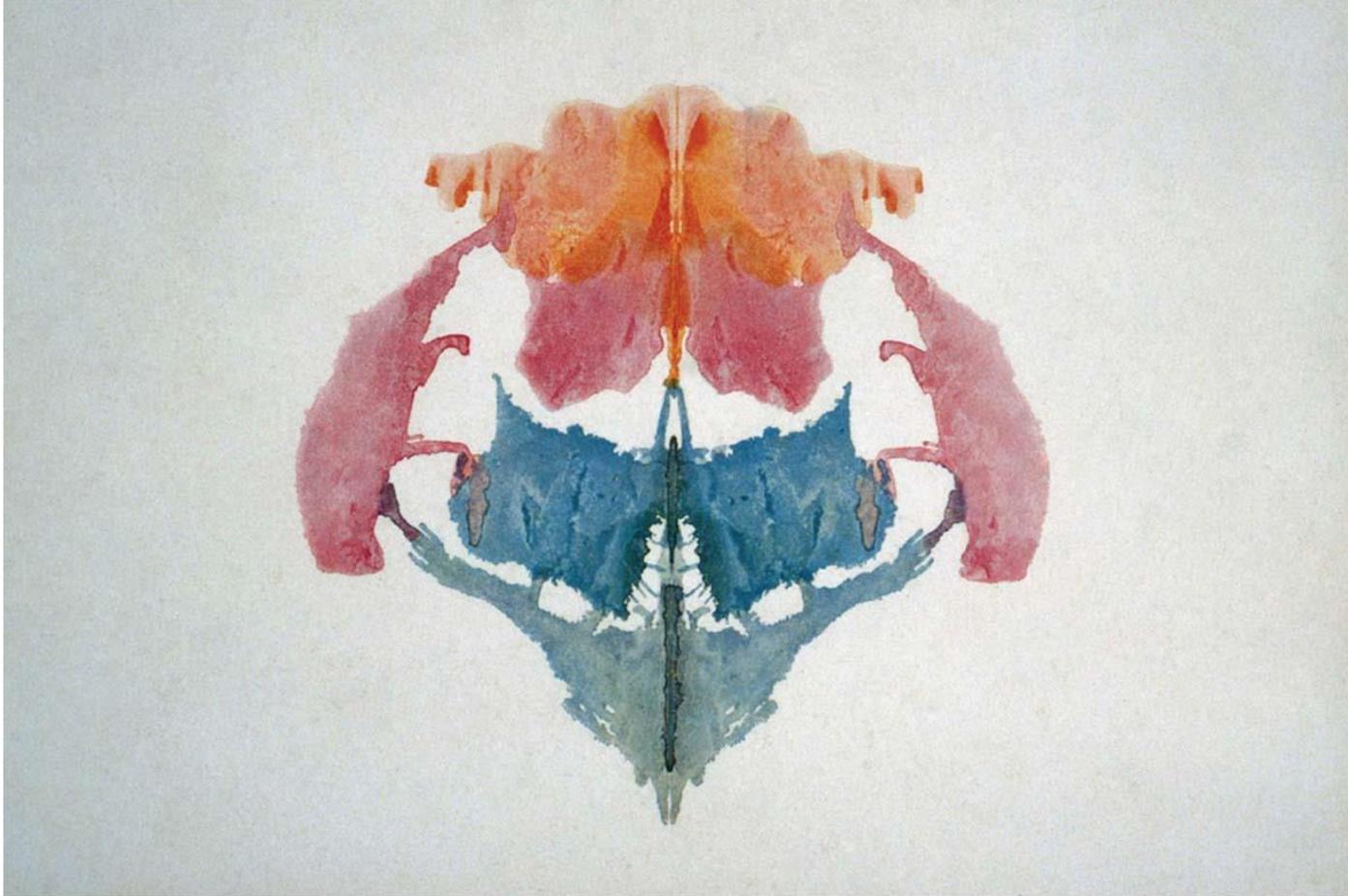


Figure 01.UN05
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Hypothesis Testing

- **The process of drawing conclusions about whether a relation between variables is supported or not supported by the evidence.**
 - **In experiments, we frame hypothesis in terms of IV and DV**

Assessing Variables

- **Operational definition**
 - Specifies how to measure or detect variable of interest
 - Depression:
 - Diminished interest in activities
 - Significant weight loss/gain
 - Fatigue (loss of energy)
 - Feelings of worthlessness
 - Recurrent thoughts of death or suicide

Go ahead try it! Operationalized Variables

The Independent Variable...	Predicts...	the Dependent Variable
Continent banking _____		who uses banking machines the fastest.
Amount of willpower _____		level of cigarette smoking.
Level of caring by administrators _____		how bad the parking problem is.
Conceptual Variable		Operationalized Variable
Continent banking	North America versus Europe	
Who uses banking machines the fastest	_____	
Amount of willpower	_____	
Level of cigarette smoking	_____	
Level of caring by administrators	_____	
How bad the parking problem is	Ask students to rate the problem on a scale ranging from 1 (no problem) to 5 (worst problem on campus).	

Conducting
Experiments to Control
for Confounding
Variables

- Several ways to do research, including **experiments** and **correlational research**.
 - Experiments are preferred because experimental results are easier to interpret
 - Often cannot conduct an experiment because it is unethical or impractical to randomly assign participants to conditions
 - Correlational studies are used when it is unethical or impractical to randomize.

Types of Research Designs

Experiments: Studies in which participants are randomly assigned to a condition or level of one or more IVs

Experiments and Causality

Using
experiments,
researchers can

**Use random
assignment**

**Control confounding
variables**

**Infer cause-effect
relation between
variables**

**Random
assignment** is the
hallmark of
experimental
research.

“Does playing video games improve laparoscopic surgical skills?”

self-selection vs random assignment.

The design of the

- first study does not answer the question
- “Does playing video games improve laparoscopic surgical skills?”

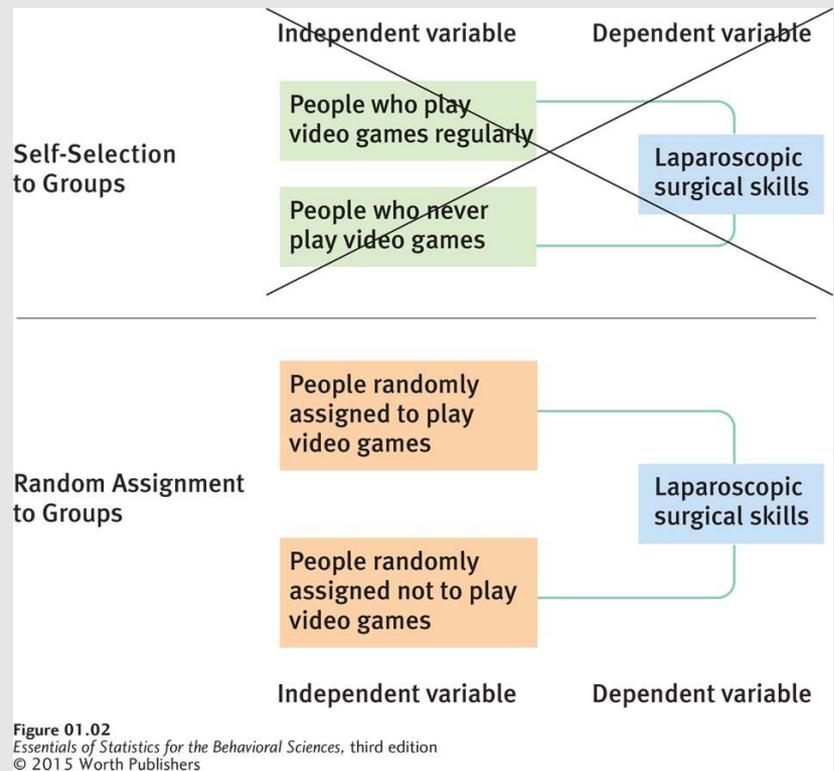


Figure 01.02
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One Goal, Two Strategies



- **Between-Groups Designs**

- Different people complete the tasks, and comparisons are made between groups.

- **Within-Groups Designs**

- The same participants do things more than once, and comparisons are made over time.

Other Research Designs

Not all research can be done through experimentation.

Unethical or impractical to randomly assign participants to conditions.

Correlational studies do not manipulate either variable.

Variables are assessed as they exist.

Types of Research Designs

Correlations: Studies which assess variables as they exist

Association between two or more variables

Correlation Between Aggression and Playing Video Games

Graph: a relation between aggression and hours spent playing video games for a study of 10 fictional participants. Interpret.

- **The more one plays video games, the higher one's level of aggression tends to be.**

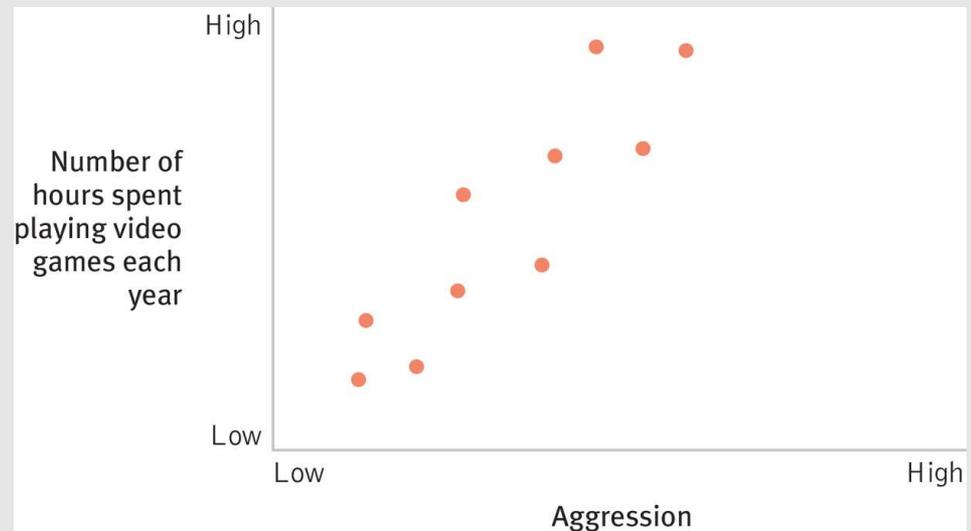


Figure 01.03
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