Module 1: Introduction

Jon Starkweather, PhD
jonathan.starkweather@unt.edu
Consultant
Research and Statistical Support



Introduction to Statistics for the Social Sciences





The RSS short courses

The Research and Statistical Support (RSS) office at the University of North Texas hosts a number of "Short Courses". A list of them is available at:

http://www.unt.edu/rss/Instructional.htm







Introduction

- Seeking Truth
- Science
- What is statistics?





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- 2 Key Terms
 - Key Terms 101
 - Key Terms 102





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- Measurement
 - Nominal
 - Ordinal
 - Interval
 - Ratio
 - Additional Considerations





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- 2 Key Terms
 - Key Terms 101
 - Key Terms 102
- Measurement
 - Nominal
 - Ordinal
 - Interval
 - Ratio
 - Additional Considerations
- Summary of Module 1





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- Science
 - Investigation.
 - Seek out answers through rigorous pursuit of valid facts and reliable phenomena.

Intro Terms Measurement Summary Truth Science Statistics?

Science

Why should we believe what science (or scientists) say?

Peer Review





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- When predictions fail, evidence is born for rejecting a theory.

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- The reason there is no quick answer is because statistics has grown to include a great many subdivisions (some of which are downright hostile toward each other).
- As you will see; for our purposes, statistics will be very narrowly defined here.





There are many divisions, just to give you an idea; consider these few:

Theoretical and Applied





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 - The Bayesian paradigm: p(H|D).



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 - Typically, italicized English letters are used as symbols for sample values; which themselves are called sample statistics.

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Key terms 101

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More on "Individuals" and the analyst's role on the next slide.

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Did you catch our narrow definition of "statistics" on the previous slide? If not; don't worry, it will come up again and again.





Population values (parameters) are typically unknown.

 We do not know the yearly salary of all professors; because, it would be impractical to collect that information from all professors (e.g., the information would likely be out of date by the time we finished collecting it).





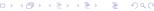
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 - Across all colleges, universities, countries...etc. That's a heck of a lot of folks!
- Perhaps we should more carefully and narrowly define our population:
 - Tenured professors teaching at public universities in the continental United States.







Because it would be impractical to assess our population directly, we tend to conduct analyses on samples with the understanding that our sample is representative of the defined population.

 We use a few terms to describe the representativeness of a sample:





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- All three terms are used to describe how well a sample result can be applied to the larger population from which it came.

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 Descriptive statistics will be a small, but essential, part of what we do here. Description is only the 1st goal of science.





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- Descriptive statistics will be a small, but essential, part of what we do here. Description is only the 1st goal of science.
- Inferential statistics will be the majority of what we do here; allowing us to explain and predict; the 2nd and 3rd goals of science.

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Basic Concepts

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- Score: A particular individual's value on a variable.



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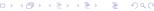


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- Continuous variables theoretically have an infinite number of possible values. 100ths of a second reaction time
- Often in the social sciences, variables are treated as continuous when we realize they truly are not capable of having an infinite number of possible values (e.g., human height).



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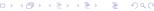




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 - Also called: output variables or outcome variables.









Variables are also classified by the content of what they express. This is often true in the context of statistical software.

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You can see how some of these might overlap (e.g., a numeric variable might also be a currency variable).

Measurement Scales





Measurement Scales

There are four **Measurement Scales** or *levels of measurement*.

Nominal: Naming things with numbers.





Measurement Scales

- Nominal: Naming things with numbers.
- Ordinal: Numbers have sequential meaning.





Measurement Scales

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Measurement Scales

- Nominal: Naming things with numbers.
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- Interval: Distances between units are equal.
- Ratio: there is a 'true zero' indicating an absence of the variable.



Nominal Scale

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This can be applied to several types of variables already mentioned using **coding**.

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 - 1 = Freshman, 2 = Sophomore, 3 = Junior, 4 = Senior.





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 - 4 = Freshman, 3 = Sophomore, 2 = Junior, 1 = Senior

Ordinal Scale





Ordinal Scale

The ordinal scale has the added property of sequence. The numbers' sequential order has meaning.

 Finishing positions of the horses in a race or rats in a maze.





Ordinal Scale

- Finishing positions of the horses in a race or rats in a maze.
- Birth order among siblings.





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 - I prefer Diet Coke (3) over Diet Pepsi (2) and both over Diet Mountain Dew (1).

Interval Scale

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- Time of day or clock time.
- The numbers identify objects or points, convey sequence, and there are equal intervals between the units.





Interval Scale

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- Time of day or clock time.
- The numbers identify objects or points, convey sequence, and there are equal intervals between the units.
 - The interval between 1 o'clock and 2 o'clock is the same as between 4 o'clock and 5 o'clock (accept on Fridays).





Ratio Scale





Ratio Scale

Ratio scale has the additional property of a true zero point; a zero which represents an absence of magnitude on the variable.

U.S. pounds of weight





Ratio Scale

- U.S. pounds of weight
 - An individual (human, non-human, or object) can not weight negative 140 lbs.





Ratio Scale

- U.S. pounds of weight
 - An individual (human, non-human, or object) can not weight negative 140 lbs.
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Ratio Scale

- U.S. pounds of weight
 - An individual (human, non-human, or object) can not weight negative 140 lbs.
- Kelvin temperature.
 - Zero degrees Kelvin means literally an absence of temperature.





Objective vs. Subjective Measurement

The "accept on Fridays" comment above is worth remembering. because it highlights another consideration in measurement: **Objective** vs. **Subjective**.





Objective vs. Subjective Measurement

The "accept on Fridays" comment above is worth remembering. because it highlights another consideration in measurement: **Objective** vs. **Subjective**.

 Objective: The clock is an example of objective measurement; if it is working correctly, it has no variance when measuring the interval between 4 o'clock and 5 o'clock on multiple days.





Objective vs. Subjective Measurement

The "accept on Fridays" comment above is worth remembering. because it highlights another consideration in measurement: **Objective** vs. **Subjective**.

- Objective: The clock is an example of objective measurement; if it is working correctly, it has no variance when measuring the interval between 4 o'clock and 5 o'clock on multiple days.
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- Subjective: Our perception tends to be more subjective; our perception of the interval between 4 o'clock and 5 o'clock varies depending on the day.
 - On Fridays, we perceive a longer interval between 4 and 5 o'clock compared to other days of the week because, we are looking forward to the weekend.

Direct vs. Indirect Measurement





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How would you define sadness? Drunkenness? Success in College?

Operational Definitions





Operational Definitions

Operation Definitions allow us to define variables with measurement. Think quantitatively. What is the quantity of this characteristic, phenomena, feature, behavior, emotion, etc.? Defining a variable operationally means defining it in such a way that description and observation are not the only benefits, but measurement as well.

Sadness





Operational Definitions

- Sadness
 - Number of crying episodes in 5 days.





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Summary of Module 1

Module 1 covered the following topics:

 The search for truth and the tenants, as well as goals, of science.





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- Some core terms, such as the distinction and importance of populations and samples.





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Summary of Module 1

- The search for truth and the tenants, as well as goals, of science.
- Some core terms, such as the distinction and importance of populations and samples.
- Other key terms related to the definition of variables.
- Some principles of measurement.
 - Nominal Scales
 - Ordinal Scales
 - Interval Scales
 - Ration Scales
 - Additional considerations of measurement/definition of variables.



This concludes Module 1

Next time Module 2.

- Next time we'll begin covering how to display data.
- Until next time; have a nice day.

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