

Lesson 2 Scales of Measure

Outline

Variables

- measurement versus categorical
- continuous versus discrete
- independent and dependent

Scales of measure

- nominal, ordinal, interval, ratio

Variables

A variable is anything we measure. This is a broad definition that includes most everything we will be interested in for an experiment. It could be the age or gender of participants, their reaction times, or anything we might be interested in.

Whenever we measure a variable, it could be a measurement (quantitative) difference or a categorical (qualitative) difference. You should know both terms for each type.

Measurement variables are things to which we can assign a number. It is something we can measure. Examples include age, height, weight, time measurement, or number of children in a household. These examples are also called quantitative because they measure some quantity. Categorical variables are measures of differences in type rather than amount. Examples include anything categorized such as race, gender, or color. These are also called qualitative variables because there is some quality that distinguishes these objects.

Another dimension on which variables might differ is that they may be either continuous or discrete. A continuous variable is a variable that can take on any value on the scale used to measure it. Thus, a measure of 1 or 2 is valid, as well as 1.5 or 1.25. Any division on any unit on the scale produces a valid possible measure. Examples include things like height or weight. You could have an object that weighed 1 pound or 1.5 pounds or 1.25 pounds. All are possible measures. Discrete variables, on the other hand, can assume only a few possible values on the scale used to measure it. Divisions of measures are usually not valid. Thus, if I measure the number of television sets in your home it could be 1 or 2 or 3. Divisions of these values are not valid. So, you could not have 1.5 televisions or 1.25 televisions in your home. You either have a television or you don't. Another way to keep this difference in mind is that with a continuous variable is a measure of "how much." A discrete variable is a measure of "how many."

Scales of Measure – whenever we measure a variable it has to be on some type of scale. The following scales are delivered in order of increasing complexity. Each scale presented is in order of increasing order.

Nominal scales – These are not really scales as all, but are instead numbers used to differentiate objects. Real world examples of these variables are common. The numbers

are just labels. So, social security numbers, the channels on your television, and sports team jersey's are all good examples of nominal variables.

Ordinal Scales – Ordinal scales use numbers to put objects in order. No other information other than more or less is available from the scale. A good example is class rank, or any type of ranking. Someone ranked at four had a higher GPA than someone ranked as five, but we don't know how much better four is than five.

Interval Scales- Interval scales contain an ordinal scale (objects are in order), but have the added feature that the distance between scale units is always the same. Class rank would not qualify because we don't know how much better one unit is than another, but with interval there is the same distance from one unit to the next anywhere we are on the scale. Examples include temperature (in Fahrenheit or Celsius), or altitude. For temperature you know that the difference in ten degrees is the same no matter how hot or cold it might be.

Ratio Scales – Ratio scales contain an interval scale (equal intervals between units on the scale), but have the added feature that there is a true zero point on the scale. This zero point is necessary for ratio statements to have meaning. Examples include height or weight or measures of amount of time. Notice that it is not valid to have a measure below zero on any of these scales. Something could not weigh a negative amount. These scales are much more common than interval scales because if a scale usually has a zero point. In fact scientist invented the Kelvin temperature scale so that they would have a measure of temperature on a ratio scale. Again, in order to make ratio statements such as something is twice or half of another then it must be a variable on a ratio scale.