

Scales of Variable Measurement

Variables are measurement using an instrument, device, or computer. The scale of the variable measured drastically affects the type of analytical techniques that can be used on the data, and what conclusions can be drawn from the data. There are four scales of measurement, nominal, ordinal, interval, and ratio. The least amount of information is contained in nominal scale data, while the most amount of information can be obtained from ratio scale data.

Nominal

Nominal scales assign numbers as labels to identify objects or classes of objects. The assigned numbers carry no additional meaning except as identifiers. For example, the use of ID codes A, N and P to represent aggressive, normal, and passive drivers is a nominal scale variable. Note that the order has no meaning here, and the difference between identifiers is meaningless. In practice it is often useful to assign numbers instead of letters to represent nominal scale variables, but the numbers should not be treated as ordinal, interval, or ratio scale variables.

Ordinal

Ordinal scales build upon nominal scales by assigning numbers to objects to reflect a rank ordering on an attribute in question. For example, assigning ID codes 1, 2 and 3 to represent a persons response to a question regarding use rate: 1 = use often; 2 = use sometimes; 3 = never use. Although order does matter in these variables (unlike nominal scale variables), the difference between responses is not consistent across the scale or across individuals who respond to the question.

Interval

Interval scales build upon ordinal scale variables. In an interval scale, numbers are assigned to objects such that the differences (but not ratios) between the numbers can be meaningfully interpreted. Temperature (in Celsius or Fahrenheit) represents an interval scale variable, since the difference between measurements is the same anywhere along the scale, and is consistent across measurements. Ratios of interval scale variables have limited meaning because there is not an absolute zero for interval scale variables. The temperature scale in Kelvin, in contrast, is a ratio scale variable because its zero value is absolute zero, i.e. nothing can be measured at a lower temperature than 0 degrees Kelvin. Time is an example of variable measured on the interval scale.

Ratio

Ratio scales have all the attributes of interval scale variables and one additional attribute: ratio scales include an absolute "zero" point. For example, traffic density (measured in vehicles per kilometer) represents a ratio scale. The density of a link is defined as zero when there are no vehicles in a link. Other ratio scale variables include number of vehicles in a queue, height of a person, distance traveled, accident rate, etc.

Reference: <http://onlinepubs.trb.org/onlinepubs/nchrp/cd-22/manual/v2chapter1.pdf>