Levels of Measurement

There are four types of number scales: NOIR

The **nominal scale** of measurement only satisfies the *identity property* of measurement. Values assigned to variables represent a descriptive category, but they have no inherent numerical value with respect to magnitude. Gender is an example of a variable that is measured on a nominal scale. Individuals may be classified as "male" or "female," but neither value represents more or less "gender" than the other. Religion and political affiliation are other examples of variables that are normally measured on a nominal scale.[1]

The **ordinal scale** of measurement has the property of both *identity and magnitude*. Each value on the ordinal scale has a unique meaning, and it has an ordered relationship to every other value on the scale. An example of an ordinal scale in action would be the results of a horse race, reported as "win," "place," and "show." We know the rank order in which horses finished the race. The horse that won finished ahead of the horse that placed, and the horse that placed finished ahead of the horse that showed. However, we cannot tell from this ordinal scale whether it was a close race or whether the winning horse won by a mile.

The **interval scale** of measurement has the properties of *identity, magnitude, and equal intervals*. A perfect example of an interval scale is the Fahrenheit scale to measure temperature. The scale is made up of equal temperature units, so that the difference between 40 and 50 degrees Fahrenheit is equal to the difference between 50 and 60 degrees Fahrenheit. With an interval scale, you know not only whether different values are bigger or smaller, but you also know how much bigger or smaller they are. For example, suppose it is 60 degrees Fahrenheit on Monday and 70 degrees on Tuesday. You know not only that it was hotter on Tuesday, but you also know that it was 10 degrees hotter.

The **ratio scale** of measurement satisfies all four of the properties of measurement: *identity, magnitude, equal intervals, and a minimum value of zero*. The weight of an object would be an example of a ratio scale. Each value on the weight scale has a unique meaning, weights can be rank ordered, units along the weight scale are equal to one another, and the scale has a minimum value of zero. Weight scales have a minimum value of zero because objects at rest can be weightless, but they cannot have negative weight.

Why does this matter? This matters because of the epidemic misuse of numbers in decision making. Ordinal scales are useful and ubiquitous. However, common practice in prioritization and risk analysis is to use ordinal scale numbers in multiplication, which is an invalid mathematical operation. Ordinal numbers should not be used in multiplication because only the order is known; the interval and ratio are unknown and therefore the product is meaningless. Assigning meaning to something that is meaningless is misuse and such misuse is epidemic.

Next: Elements of effective decision-making methodologies

[1] http://stattrek.com/statistics/measurement-scales.aspx?Tutorial=AP.