Scales of Measurement

The concept of **scales of measurement** refers to rules for assigning scale values to measurements.

Nominal

A scale of measurement in which the scale values represent categories that only differ from one another qualitatively (i.e., differ in “type” rather than in “amount”). In other words, the different values of a variable are categories that only represent different “types” of something. Variables measured using a nominal scale are also known as "qualitative" variables.

Examples are ethnic group membership, your college major, religious affiliation, eye color, political affiliation.

Numbers are used merely to represent unique categories and have no mathematical properties:

Example: Political affiliation might be coded on a questionnaire in any of the following ways. The numbers are arbitrary and each method is as good as the others.

Option 1	*Option 2*	*Option 3*
1 = Republican	1 = Democrat	1 = Independent
2 = Democrat	2 = Republican	2 = Republican
3 = Independent	3 = Independent	3 = Democrat
4 = Other	4 = Other	4 = Other

Ordinal:

A scale of measurement in which the scale values represent categories that differ quantitatively in terms of their order, but in which the intervals between numbers (i.e., between categories) cannot be assumed to be equal.

Examples are 1st 2nd and 3rd place finishers in a race, birth order, rank order of your 5 favorite movies from all time, rank your top 3 friends, your class rank.

In a race, we cannot assume that the difference in time between the first and second place finishers is the same as the difference in time between the second and third place finishers. The numbers only tell us about the order in which they crossed the finish line.

Likewise, when you rank order the names of your three favorite friends, the numbers 1, 2, and 3 only tell us who you like most, second most, and third most. Perhaps you like your top ranked friend a lot more than your second ranked friend. Perhaps you like your top two friends almost equally. If we measure friendship on an ordinal scale by obtaining rankings, we cannot make assumptions about distances between the ranks.

Interval

A scale of measurement in which the distance between any two adjacent scores is the same as the distance between any other two adjacent scores. However, there is no "true" or "natural" zero point and therefore meaningful ratios cannot be formed. In short, numbers are spread across equal intervals without a natural zero point.

An example is temperature, measured either in degrees Celsius or degrees Fahrenheit. The intervals are equidistant (i.e., a 1 degree increase from 15 to 16 degrees represents the same amount of increase in temperature as does 30 to 31 degrees, but 30 degrees is not "twice as hot" as 15 degrees).

NOTE: Many variables measured by psychologists are often analyzed statistically as if they were measured on an interval scale. Common examples include IQ scores, personality test scores, aptitude test scores, and scores from rating scales and attitude scales [e.g., "To what extent do your disagree or agree with the following statement: Congress is doing a good job: -2 (Strongly Disagree) -1 (Disagree) 0 (Neutral) +1 (Agree) +2 (Agree Strongly)"]. There is considerable disagreement, however, as to whether the scale of measurement for these variables truly is an interval scale, or better represents an ordinal scale. For example, does the 5-point difference in IQ scores of 110 versus 105 represent the same amount of difference in intelligence as that represented by IQ scores of 105 versus 100? In measuring attitudes, does the 1-point difference between "Strongly Agree" and "Agree" represent the same amount of change in the strength of an attitude as the 1-point difference between "Agree" and "Neutral"?

One thing is for sure, an IQ score of 130 or an attitude rating of +2 (Strongly Agree) cannot be interpreted as meaning that someone has twice as much intelligence or twice as positive an attitude as someone who has an IQ score of 65 or an attitude rating of +1 (Agree).

Ratio

With ratio scales, the scale values are numbers that represent equal distances in some attribute, and there also is an absolute zero point. Thus, meaningful ratios can be formed.

Examples are length, height, weight, time, number of errors made performing a task, and number of tickets sold.

If IQ scores were ratio (they are not), you could say that someone with a 130 IQ was twice as smart as someone with a 65 IQ (a ratio of 2 to 1), but we cannot make this claim. However, for height measured in inches, which is a ratio scale, you may properly say that somebody 60 inches tall is twice as tall as somebody 30 inches tall.