Levels of Data Measurement and Likert-type Scales

Excerpted from Simon, M. K., and Goes, J. (2013). *Dissertation and scholarly research: Recipes for success* (2013 Ed.). Seattle, WA, Dissertation Success, LLC.

Data come in four types and four levels of measurement, which can be remembered by the French word for black:

NOIR: nominal (lowest), ordinal, interval, and ratio highest

Nominal Scale	Measures in terms of name of designations or discrete units or categories. Example: gender, color of home, religion, type of business.
Ordinal Scale	Measures in terms of such values as more or less, larger or smaller, but without specifying the size of the intervals. Example: rating scales, ranking scales, Likert-type scales.
Interval Scale	Measures in terms of equal intervals or degrees of difference but without a true zero point. Ratios do not apply. Example: temperature, GPA, IQ.
Ratio Scale	Measures in terms of equal intervals and an absolute zero point of origin. Ratios apply. Example: height, delay time, weight.

A general and important guideline is that the statistics based on one level of measurement should not be used for a lower level, but can be used for a higher level. An implication of this guideline is that data obtained from using a Likert-type scale (a scale in which people set their preferences from say 1 = *totally agree* to 7 = *totally disagree*) should, generally, not be used in parametric tests. However, there is controversy regarding treating Likert-type scales as interval data (see below). However, if you cannot use a parametric test, there is almost always an alternative approach using nonparametric tests.

Likert-type scales are used to quantify results and obtain shades of perceptions. Choices (or categories of responses) usually range from strongly disagree to strongly agree. As the

categories move from one to the next (e.g., from strongly disagree to disagree), the value will increase by one unit. Likert-type scales are assumed to have equal units as the categories move from most negative to most positive. This allows measurement of attitudes, beliefs, and perceptions, and provides a means of quantifying the data.

Although Likert-type scales are very common when a survey instruments are used to measure variables in the study, they are also surrounded with controversy. It is important to understand the debate surrounding this measurement tool when statistics are needed to test a claim based on the data obtained from a survey using a Likert-type scale.

Can Likert-type scales be considered interval?

Likert-type scales (ex., strongly agree, agree, etc.) are ordinal data but very commonly used with interval procedures, provided the scale item has at least 5 and preferably 7 categories. Most researchers would not use a 3-point Likert-type scale with a statistical technique requiring interval data. The fewer the number of points on the scale, the more likely the departure from the assumption of normal distribution, required for many tests of hypothesis. Here is a typical footnote inserted in research using interval techniques with Likert-type scales:

> "In regard to our use of (insert name of statistical test), which assumes interval data, with ordinal Likert-type scale items, a review of the literature on this topic, Jaccard and Wan (1996, p.4) concluded, "for many statistical tests, rather severe departures (from *intervalness*) do not seem to affect Type I and Type II errors dramatically; especially if a 5 or 7 point scale is used."

It is important to note that Likert himself, in his original paper, did not consider the number of choices to be an important issue (Likert, 1932) stating only that "If five alternatives are used, it is necessary to assign values from one to five with the three assigned to the undecided position." It is implied that the actual number of choices may be left to the tastes of individual researchers. Devellis (1991) also found that the number

of questions asked affects the reliability of the number of choices that should be used in creating a survey using Likert-type scale. In practice researchers often assign the number of choices arbitrarily according to personal taste or past convention.

References

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