Some of us may remember S. S. Stevens, famous in the 1950's for his discussion of scale types (S. S. Stevens, 1951). To use regular statistics, often called parametric, you need at least an interval scale, he said. And preferably a ratio scale if you wanted to do advanced mathematics on your data. It sounded persuasive to many. One solution to the problem was to develop and use statistical methods only requiring rank order data, so-called non-parametric methods. Siegel wrote a successful text about such methods (Siegel, 1956), and they are still around in text-books and software packages.

Behavioural researchers went on using the usual Likert or category scales, however, in spite of the fact that they obviously cannot be shown to yield interval scales. Some of us do so with a vague feeling of guilt, and our colleagues in statistics are often keen at pointing out that what we do is wrong and not permissible. They are right in principle but wrong in practice. Why?

There are several important arguments to be made here, and some irrelevant or misleading. First, Lord’s famous formulation “the numbers don’t know where they came from” (Lord, 1953) is witty but defunct. The researchers don’t want to draw conclusions about just the numbers. They have obtained those numbers for the purpose of measuring an underlying dimension of interest. They want to draw conclusions about that dimension. Second, the argument that “we have always done it, and so does almost everybody else” is also defunct as a rational argument. Obviously, the mere fact that a procedure is popular is no argument for its validity. So, what are some valid arguments in favour of analyzing Likert-scale types of data as if they were interval measurements? Here are seven:

1. It is being done and it yields meaningful results and a coherent body of knowledge. That would probably not happen if the data were vastly different from an interval scale. Even a cursory look at methodology in use and reported in such leading journal as the JPSP (Journal of Personality and Social Psychology) verifies this assertion.

2. Comparisons between parametric and non-parametric methods tend to give the same results, but non-parametric methods usually have lower power.

3. Many advanced types of analysis in the Analysis of Variance cannot be performed with non-parametric methods.

4. It is reasonable to assume that deviations from a true interval scale are modest. Only drastic and very large deviations would lead to erroneous conclusions.

5. Norman Anderson’s work on functional measurement has produced a large body of meaningful and important results (Anderson, 1981, 1982) which all support the underlying assumption of an interval scale, based on quantitative modelling.
6. Attempts at various forms of conjoint measurement, using only ordinal properties of data, have so far failed in producing practically useful methods for most applications (Cliff, 1992).

7. Stevens’s own solution to the problem was the use of magnitude or ratio estimation, which presumably should give ratio scales and be vastly superior to category scales (S.S. Stevens, 1957). However, people protest when being asked to make ratio judgments. They feel that such judgments are an unnatural and very difficult thing to do. And, when such data are acquired anyway, they display very difficult inconsistencies which have never been fully understood (Eisler, 1962; Sjöberg, 1971). The dream of building a mathematically formulated science on such data was shattered by the enormous dispersions of data across individuals, huge in quantitative terms and, even worse, of a qualitative nature. Only by ignoring these realities can we reach such simple results as favoured by some of the researchers in this tradition, see a more extensive discussion in Sjöberg (Sjöberg, 1977).

Conclusion

The problem of scale level is unfortunately still alive and well, in the writings of, especially, statisticians. They are right in principle but probably seldom aware of the counterarguments mentioned above, which fully justify current practice which amounts to simply forgetting about the whole thing. May it rest in peace.

References