

Estimating Perceptual Scales with Interval Properties

Kenneth Knoblauch¹ and Laurence T. Maloney²

1. Stem Cell and Brain Research Institute, Inserm U846, Bron, France

2. Dept. of Psychology and Center for Neural Science, New York University, New York, NY, USA

Perceptual scales obtained from stimulus paired-comparisons are typically limited to an ordinal interpretation. Several approaches, however, based on judging stimulus intervals permit the estimation of scales with interval properties, i.e., equal intervals are perceptually equal. 1) *Difference Scaling* requires observers to judge the differences between pairs of pairs of stimuli. The observer chooses the stimulus pair between which the difference is perceived to be greatest. The procedure can be simplified using triples rather than quadruples of stimuli, so that the observer compares the interval between the first and second stimuli with that between the second and third. 2) In *Conjoint Measurement*, the observer judges pairs of stimuli but with each varying along two or more physical dimensions. Observer choices are based on an additive combination of responses to the different physical scales. Rearrangement of the terms of the decision rule, however, shows that these paired-comparisons depend on judging response differences (or intervals) on each of the physical scales so that the procedure also generates an interval scale. Data from experiments using these tasks can be analyzed in **R** with the packages **MLDS** and **MLCM** that provide functions for obtaining maximum likelihood estimates of the scale values. The decision rules for each of these tasks are formally similar and can be re-parameterized as a GLM. For multi-observer data sets, this lends itself to relatively simple application of mixed-effects models using functions from existing packages.