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Empirical Evaluation of Axioms Fundamental to Stevens' Ratio-Scaling Approach

Wolfgang Ellermeier & Günther Faulhammer

*Institut für Psychologie
Universität Regensburg
93040 Regensburg
Deutschland*

wolfgang.ellermeier@psychologie.uni-regensburg.de

Stevens' direct scaling methods rest on the assumption that subjects are capable of reporting or producing ratios of sensation magnitudes. Only recently, however, an axiomatization proposed by Narens [J. Math. Psych., 40, 109-129 (1996)] specified necessary conditions for this assumption that may be put to an empirical test. In the present investigation, the central axioms of commutativity and multiplicativity were evaluated by having subjects produce loudness ratios. It turned out that the adjustments were consistent with the commutativity condition; multiplicativity (the fact that consecutive doubling and tripling of loudness should be equivalent to making the starting intensity six times as loud), however, was violated in a significant number of cases. According to Narens' axiomatization, this outcome implies that though in principle, a ratio scale of loudness exists, the numbers used by subjects in order to describe sensation ratios may not be taken at face value.