TOWARD A UNIFIED THEORY OF PSYCHOPHYSICS

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SUMMARY

This Thesis proposes a means of unifying psychophysics. No new concepts are invoked; the model is a rearrangement of existing ideas and principles. First, it is shown that magnitude scales of sensation fail to comply with rigorous validity criteria. It is argued this occurs because the number continuum, in magnitude tasks, is perceived in a logarithmic manner. This explanation offers a means of resolving the discrepancy between magnitude and category scales.

A re-evaluation of the psychophysical law suggests that a valid psychophysical function may be derived from two theoretical premises: the empirical Weber function (not Weber's law), and Fechner's original assumption that just noticeable differences (JNDs) are subjectively equal. These premises specify the obsolete JND (or DL) scale. The present model also predicts, however, that a valid psychophysical function may be obtained by direct interval estimation techniques, e.g., category rating. The concomitant prediction is that, for a given modality, the psychophysical function obtained by direct interval estimation should be isomorphic with the function derived by cumulating JNDs. This isomorphism is shown to be supported

by published work in a number of sensory modalities, and also to be consistent with the properly validated findings of functional measurement analysis.

All experiments in the Thesis were conducted in the taste modality. First, the predicted JND scale-category scale isomorphism is confirmed for taste stimuli representative of the four basic tastes: sweet, acid (sour), salty, and bitter. Methodological bias in the category rating of taste intensity is investigated and found not to be a serious problem in the present approach; nevertheless, a procedure for avoiding contextual bias is suggested and tested experimentally.

A further experiment offers some support for the contention of the present model that rating scales are valid because they involve subjects matching sensation to the position on a line. Finally, in two experiments, the interaction of the sweeteners sucrose and fructose is explored using the functional measurement paradigm. Support for sweetness additivity at low concentrations provides a properly validated estimate of the psychophysical function for sucrose. This function is found to correspond well with the JND and category scales for sucrose obtained earlier, and also corroborates Fechner's assumption of the subjective equality of JNDs.

DECLARATION

I, Robert Lemon McBride, declare that the work contained in this Thesis is original and my own work except where acknowledged in the text. This Thesis has not been submitted to any other university or institution.