

R DUNCAN LUCE

Subjective Intensity Is Appreciably More Complex Than Usually Acknowledged: Cross-Modal Matching of Binary and Unary Intensity Attributes.

Abstract:

A substantial empirical literature on cross modal matching of subjective intensities exists, but there has been very little by way of theory. Attributes with two relatively independent sense organs, such as ears, eyes, arms, etc., are called binary modalities. For these behavioral assumptions (axioms) lead to numerical representations. Empirical work of R. Steingrímsson & Luce for loudness and that of Steingrímsson for visual brightness and perceived contrast has provided support for the theory. Moreover, strong empirical evidence for bisymmetry and against commutativity for both the three attributes forces a simple additive representation over the two sense organs. These psychophysical functions have also been shown to be power functions.

However, many intensity modalities, such as vibration, shock, money value, taste, etc., seem to be unary (1-dimensional) rather than binary (2-dimensional). Helmholtz's (1901) theory of extensive measurement seems suited to the unary cases. But, in addition to the additive representation, as in the binary theory, two other representations arise when the representation is into the additive and multiplicative real numbers. These have gone unnoticed for over 100 years. Unlike the binary cases, no behavioral properties seem to rule them out. A criterion is given for deciding, for each respondent, which of the 3 types applies.

This complexity must be taken into account when considering cross-modal matches. Quite a few predictions result: for the binary/binary cases, for the unary/unary cases, and for the binary/unary cases. Thus, an extensive experimental effort needs to be undertaken that involves testing whether the unary theory is sustained and, if so, whether or not the complex of cross-modal predictions seem to be correct..