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On the additivity law of luminance : (Treatises on color scales : 3)

Tarow Indow

As one of the treatises in a continued series making inquiries into psychological problems involved in photometry and colorimetry, the present article provided a detailed account of all the postulates inherent in the present definition of the psychophysical concept: *light*. In regard to the C. I. E. luminosity curve, discussions were made about individual differences in its source data, the psychophysical procedures employed, restrictions in the observational conditions and so on, but special emphasis is laid on the role played by Abney's law, i.e., the additivity of luminance. Hence, results of the recent experiments made by MacAdam, Sperling, Fedorov etc., which concern directly or indirectly with the additivity assumption, were reviewed with the conclusions as follows.

If Abney's law holds at all, it does only under luminance matches by the flicker method. Direct comparison methods do not consistently support the precise additivity of luminance. The additivity principle, however, underlies all the present systems of photometry and colorimetry. Nevertheless, the flicker method could not reasonably be accepted as the sole basis for photometric measurements to the exclusion of direct observations. Though useful, the flicker photometry is a secondary procedure in the sense that it is less closely related to ordinary conditions of observing colors. Photometry and colorimetry have served more than thirty years for practical purposes with no serious trouble, which would indicate that the deviations from additivity be of the magnitude that can be tolerated in ordinary situations where colors are under direct observation but no direct comparison is involved. Hence, textbooks are warranted in taking the additivity principle for granted. From the viewpoint of psychophysics, however, it might be of importance to make clear

that Abney's law has been established accurately only by the flicker method.

It was argued that luminance is ultimately based on the determination of the equality in brightness and remains to be the lower metric of brightness even when it is defined with internal consistency. Higher metric should answer the question by how many times one brightness differs from another.