Do observers use the mean, the median or the mode?

Ione Fine Department of Psychology, UCSD, USA
Geoffrey M. Boynton, The SALK Institute, UCSD, USA

Some estimators of central tendency (CT) are more robust than others in that their performance is less sensitive to the presence of outliers or departures from model assumptions (Hampel, Ronchetti, Rousseeuw & Stahel, *Robust Statistics: The Approach based on Influence Functions*, 1986). For example, the mean is a far less robust estimator of central tendency than either the median or the mode. We used two tasks to test whether observers' estimates of brightness and global motion were based on robust estimators. *Direction of global motion:* observers matched the global direction of motion of a field of dots to the orientation of stationary bar (aperture radius = 2.5deg; dot radius = 2.1sec; speed = 5 deg/sec). The distribution of individual dot directions was drawn from a wide variety of distributions, including a series of exponential distributions that varied in their standard deviations. Exponential distributions were chosen because robust and non-robust measures of CT are widely separated for these highly asymmetric distributions. *Brightness:* Observers matched the brightness of a texton patch whose luminances were drawn from a series of exponential distributions to that of a uniform patch (patch radius = 2.5deg; texton elements = 6.4 x 6.4 sec; luminance range 45-70 cd/m^2). *Conclusions:* Observers' estimates of both direction of motion and brightness were far more robust than the mean: falling between the median and the mode. Observers' percepts were therefore not consistent with pooling models that simply average responses to individual elements. For estimates to be more robust than the median requires that outliers have little or no influence on observers' global percepts. This rejection of outliers may underlie segmentation, since it seems to have perceptual consequences. For example, dots with outlying directions of motion appear as "stray" dots, disassociated from the global flow.

Supported by a LJIS fellowship EY-01711.