AB002. The role of equivalent internal noise and processing efficiency in individual differences in stereoacuity

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Background: The human visual system can use binocular disparity to make depth judgements. Previous studies looking at the normal population have found a wide range in ability to perform depth-polarity tasks. We explored if these large individual differences are also present when using a depth increment paradigm, and if they depend on the sign of disparity.

Methods: Stereoacuity for detecting a wedge-shaped surface in a field of dots was measured in 53 adults (28 males) with normal vision. To better understand the variance in stereoacuity in the sample, for 18 subjects we measured stereo cuity with disparity noise added to the stimulus. Stereoacuity was unaffected at low levels of stimulus noise but beyond a critical value, it increased with the standard deviation of the noise. At this point the stimulus noise is equivalent to the internal noise of the subject. Stereoacuity measured at high stimulus noise levels reflects the efficiency with which a noisy input is processed by the visual system. We derived both parameters by fitting the linear amplifier model.

Results: Stereoacuity ranged from 24 to 275 arc seconds. We found population differences in stereoacuity were explained by variation in both processing efficiency and internal noise levels. There was a tendency for higher task performance for crossed disparities compared to uncrossed disparities. Within subject sensitivity differences between crossed and uncrossed disparity were due to a higher efficiency when processing one direction. There was a trend for subjects with equal acuity for the two directions to have an increase in processing efficiency compensating for higher internal noise levels for that direction.

Conclusions: Overall, our results show that the individual differences in stereoacuity for depth increment tasks can be attributed to variances in both the quality of the received input and the efficiency of processing of disparity-processing mechanisms.

Keywords: Vision; psychophysics; depth percept

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