Area MT neurons at the population level represent binocular disparity in a manner between correlation-based and match-based representation

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Binocular disparity is a cue for stereopsis. Psychophysical evidence suggests that the visual system represents binocular disparity based on both binocular-correlation and binocular-match signals. We previously showed that area V4 employs a match-based representation of disparity in responses pooled across neurons. As a step towards identifying the brain areas that represent disparity with binocular-correlation signals, we examined the disparity representation of MT, a counterpart of V4 in the dorsal visual pathway. We recorded single-unit activity of MT neurons from a monkey performing a fixation task and analyzed the pooled-average of the resulting tuning curves. We then manipulated the level of binocular correlation in random-dot stereograms (RDSs) by reversing the luminance contrast of a varying proportion of dots in one eye (graded anti-correlation). The amplitude of pooled disparity-tuning curve gradually decreased as the level of correlation was decreased from 100% (normal RDSs) to 0% (RDSs with half of the dots contrast-reversed). At 0% correlation, the tuning curve became completely flat. With further decrease from 0% to −100% (anti-correlated RDSs), response modulation by disparity reappeared, gradually grew, and exhibited an inverted tuning-curve shape. The tuning amplitude at −100% correlation was approximately 40% of the amplitude at 100% correlation. These changes in disparity tuning functions fall between correlation-based and match-based representation of binocular disparity. MT thus represents disparity in a more correlation-based manner than V4, whose representation is completely match-based at the population level. No COI.