V1 interactions reduce local uncertainty about binocular disparity over time

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Recent studies have proposed that binocular disparity-dependent interactions among V1 neurons reduce stereo mismatches and sharpen disparity tuning over time. The temporal sharpening of disparity tuning suggests that these interactions are reducing uncertainty about stereo matching. We tested for this possibility by measuring the Fisher information that the mean firing rate provides about disparity over time during the presentation of dynamic random dot stereograms. We found that Fisher information gradually increases shortly after response onset. Information increases mostly near the peak and at the steepest slope of the tuning curve. When we introduced noise to stimuli and increased stereo ambiguity, and therefore increased uncertainty about stereo matching, we found that disparity tuning developed at a slower rate than our original dynamic random dot stereograms. However, the sharpening and increase in Fisher information was more dramatic for these new conditions. These findings suggest that the neuronal interactions were playing a more prominent role during more ambiguous stereo computations.