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Differential temporal integration of 2D and 3D motion

Jay Hennig, Leor Katz, Lawrence Cormack, Alexander Huk

Center for Perceptual Systems, Departments of Neuroscience and Psychology, The University of Texas at Austin

The temporal integration of noisy motion information has been studied extensively along the frontoparallel plane (2D). However, it is unknown whether the integration of motion information through depth (3D) is governed by similar principles.

Subjects performed a direction discrimination task with variable motion coherence over a large range of stimulus viewing durations, providing us with measures of discrimination accuracy over a range of difficulties for both 2D and 3D motion. Psychophysical accuracy improved for longer viewing durations in both configurations, with overall accuracy lower in 3D motion discrimination. In both cases, the rate of improvement of accuracy with motion duration could be divided into three sequential stages, in accord with previous accounts: (1) a brief, rapid improvement during the first ~100 milliseconds, consistent with early sensory processing; (2) a more gradual improvement over the following several hundreds of milliseconds, consistent with temporal integration underlying decision formation; (3) a final stage in which accuracy ceases to improve with durations over about one second, consistent with an upper limit on integration.

The critical difference between 2D and 3D motion integration occurs in the decision formation stage. In the 2D motion configuration the relation between accuracy and duration in this stage is consistent with near-perfect temporal integration. Accuracy in the same stage of the 3D configuration, however, showed a significantly shallower dependence on motion duration. We conclude that temporal integration of 3D motion shares similarities with that of 2D, but relies on a less optimal integration strategy at the decision stage.

Katy Seloff & Matt Pomrenze at ins.symposium@gmail.com with questions or concerns.