Distinguishing between parallel and serial accounts of multiple object tracking

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Abstract

Humans can attentionally track multiple moving objects. Is this accomplished by attending to all the objects at the same time or do we attend to each object in turn?

We addressed this fundamental question using a novel application of the synchronous-asynchronous paradigm. Participants viewed four groups of dots, each group containing four dots, each group located in its own quadrant. During the trial, which lasted seven seconds, each group of dots would rotate around the center of its quadrant, 90 degrees at a time, with a pause between rotations. The direction of successive rotations was random. Participants tracked one dot in each group. In one condition, all groups rotated synchronously. In the other condition, the groups rotated asynchronously so that at any given time only half the groups were rotating. If observers track dots serially, then the asynchronous condition should yield superior performance since fewer dots move simultaneously. Conversely, a standard parallel account predicts comparable performance in the two conditions. Surprisingly, we found that performance was actually better in the synchronous condition than in the asynchronous condition, disconfirming a serial account. We speculate that the motion onset transients in the asynchronous condition involuntarily switched attention between dots, thereby disrupting the parallel tracking mechanism.

There is evidence that tracking occurs independently in each cerebral hemisphere (Alvarez & Cavanagh, 2005, Psychological Science, 16, 637). While this might explain why dots in different visual hemifields can be tracked in parallel, when we confined all the dots to just one visual hemifield, performance was still greatest in the synchronous condition. In fact, when all the dots were confined to just one quadrant, performance was still inconsistent with a serial account. We conclude that multiple object tracking is achieved in parallel across the visual field.