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Attentive tracking involves a demand-based dynamic redistribution of attention.

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People can attentively track multiple targets randomly moving among identical distractors. We analyzed target-localization errors to elucidate the mechanisms underlying this ability. We sought to determine (1) whether the underlying mechanisms track position, velocity, or both, and (2) whether they assign a discrete "attention index" to each target, or rather flexibly allocate more resources to targets when they are temporarily crowded by distractors. Testing these hypotheses required measurements of how accurately observers tracked each target's location and velocity. METHOD. On each trial, observers (N = 20) tracked 3 targets moving among 7 distractors. The targets were red, green, and yellow, and the distractors were assigned the same colors. This permitted color-based post-cueing. After 6 seconds of tracking, the display disappeared coincident with an aural cue of a color name. The observer mouse-clicked the last-seen location of the target of the post-cued color. Central eye fixation was enforced using an unpredictable digit-identification task. RESULTS. The direction of localization error (the vector from the true position to the mouse-clicked position) was correlated with the target's motion direction, indicating that observers tracked the motion direction of each target. The lack of correlation between the angular error (the angular difference between the direction of the localization error and the target's motion vector) and the absolute localization error (the distance between the mouse-clicked position and the true position) suggested that relatively independent mechanisms tracked velocity and position. Finally, tracking became increasingly precise as targets were surrounded by more distractors (within 3.37° diameter), indicating that greater attentional resources were dynamically allocated to crowded targets and away from less-crowded targets. These results show that during attentive tracking of multiple targets, (1) spatial distribution of attentional resources is continuously adjusted in a demand-based manner, and (2) the underlying tracking mechanisms monitor both position and velocity.