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Attention Mechanisms for Multi-Location First- and Second-order Motion Perception

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We applied the external noise plus attention paradigm to study attention mechanisms involved in *concurrent* first-order and second-order motion perception at two spatial locations. Cued to attend to one of the locations, the observer was instructed to independently judge direction of motion of either first-order (Experiment 1) or second-order (Experiment 2) motion stimuli at both locations in every trial. Across trails, systematically controlled amounts of external noise were added to the motion displays. We measured motion threshold at three performance criteria in every attention*external noise condition. We find that observers could, without any loss, simultaneously compute first-order motion direction at two widely separated spatial locations across a broad range of external noise conditions. However, considerable loss occurred at the un-attended location in processing second-order motion direction at two separated spatial locations. We conclude that, under the conditions investigated in the current study, (1) in first-order motion perception, the visual system could simultaneously process motion direction at two widely separated locations without any capacity limitation; (2) in second-order motion perception, attending to a spatial location enhances stimulus contrast at that location by a factor of about 1.37 (or equivalently, reduces the internal additive noise by a factor of about 0.73.).