The Functional Architecture of Human Visual Motion Perception
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A powerful paradigm (the pedestal-plus-test display) is combined with several subsidiary paradigms (interocular presentation, stimulus superpositions with varying phases, and the attentional manipulations) to determine the functional architecture of visual motion perception: that is, the nature of the various mechanisms of motion perception and their relations to each other. Three systems are isolated: A first-order system that uses a primitive motion energy computation to extract motion from moving luminance modulations; a second order system that use motion energy to extract motion from moving texture-contrast modulations and a third-order system that tracks features. Pedestal displays exclude feature tracking and thereby yield pure measures of the first-and second-order systems which are found t be exclusively monocular. Interocular displays exclude the first- and second-order systems and thereby to yield pure measures of feature-tracking. results: Both first-and second-order systems are fast (with temporal frequency cutoff at 12 Hz) and sensitive. Feature tracking operates interocularly almost as well as monocularly. It is slower (cutoff frequency is 3 Hz) and it requires much more stimulus contrast than the first- and second-order systems. Feature tracking is both bottom up (it computes motion from luminance-modulation, texture-contrast modulation, depth-modulation flicker-modulation, and from other types of stimuli) and top-down-- e.g., attentional instructions can determine the direction of perceived motion.