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Stereomotion is processed by the third-order motion system: reply to comment

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Two theories are considered to account for the perception of motion of depth-defined objects in random dot stereograms (stereomotion). In the Lu-Sperling three-motion-systems theory [J. Opt. Soc. Am. A **18**, 2331 (2001)], stereomotion is perceived by the third-order motion system which detects the motion of areas defined as figure (versus ground) in a salience map. Alternatively, Patterson proposes a low-level motion energy system dedicated to stereo depth. The critical difference between these theories is the preprocessing (figure-gound based on depth and other cues versus simply stereodepth) rather than the motion-detection algorithm iteslf (because the motion extraction algorithm for third-order motion is undetermined.) Furthermore, the ability of observers to perceive motion in alternating feature displays in which stereo depth alternates with other features such as texture-orientation indicates that the third-order motion system can perceive stereomotion. This reduces the steremotion question to: third-order along or third-order plus dedicated depth-motion processing? Two new experiments intended to support the dedicated depth-motion processing theory are shown here to be perfectly accounted for by third-order motion, as are many older experiments that have previously been shown to be consistent with third-order motion. Cyclopean and vivalry images are shown to be a likely confound in stereomotion studies, rivalry motion being as strong as stereomotion. The phase dependence of superimposed same-direction stereo motion stimuli, rivalry stimuli, and isoluminant color stimuli indicates these stimuli are processed in the same (third-order) motion system. The phase-dependence paradigm [Lu and Sperling, Vis. Res., **35**, 2697 (1995)] ultimately can resolved the question of which types of signals share a single motion detector. All the evidence accumulated so far is consistent with the three-motion-systems theory.