Visual detection of moving objects during walking in crickets

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Visual detection of dynamic objects during locomotion needs complex processing in mobile robots, and we are interested in how insects achieve the task. We developed a closed-loop system where a tethered cricket walking on a Styrofoam ball and its rotation was fed back to movements of visual scenery projected onto a screen in front of the cricket. We presented three kinds of visual stimuli, static objects, moving objects (independent movements), and objects that moved only when the cricket walked (concerted movements). The results indicated that the walking crickets stopped more frequently and longer when the independent and concerted movements of objects were presented. Before the longer stops, we found that expansion/contraction rate of the object edges was higher than that of the shorter stops. Regarding the longer stop as an index of visual detection of moving objects, we speculated that the expansion/contraction rate of the object edges is one of the keys to detect moving objects during walking.