



Fig. S1. The independence of cockroach walking velocity from the stimulus rotation velocity in open-loop experiments. *Filled circles* denote the angular velocity of the stimulus pattern at different temporal frequencies. *Boxplots* present the median \pm 1st and 3rd quartile of the cockroach walking velocity and the “*whiskers*” show the 5th and 95th percentile of the data. Minimum and maximum values are shown with *X*’s and mean values with *squares*. Medians range from 32.4 to 98.4° s⁻¹. Pairwise comparisons were done to the walking velocities and significant differences were only found between 0.1 and 2.4 Hz (one-tailed Two sample Wilcoxon signed rank test, $P=0.00257$) and 0.1 and 4 Hz ($P=0.01542$). The independence is explainable with the functional mode of the setup: in an open-loop experiment the animal cannot affect the stimulus and thus cannot catch it up to stabilize the perceived motion on their retinas. Continuous perceived motion will keep the animals turning in the direction of the stimulus rotation.



Movie 1. Responses of a tethered American cockroach to the presentation of rotating 2.4 Hz optomotor stimuli at light intensity of 500 lux. During the stationary control the cockroach walks somewhat straight, scanning with its antennae. Stimulus rotation elicits an initial startle, after which the animal pursues to follow the movement. During the second control the cockroach resumes straight walking, and the clockwise rotation induces another following reaction. At 45 s the cockroach stops for six seconds, during which only antennal movement is seen, and then continues to walk until the lights are switched off at the end of the experiment.