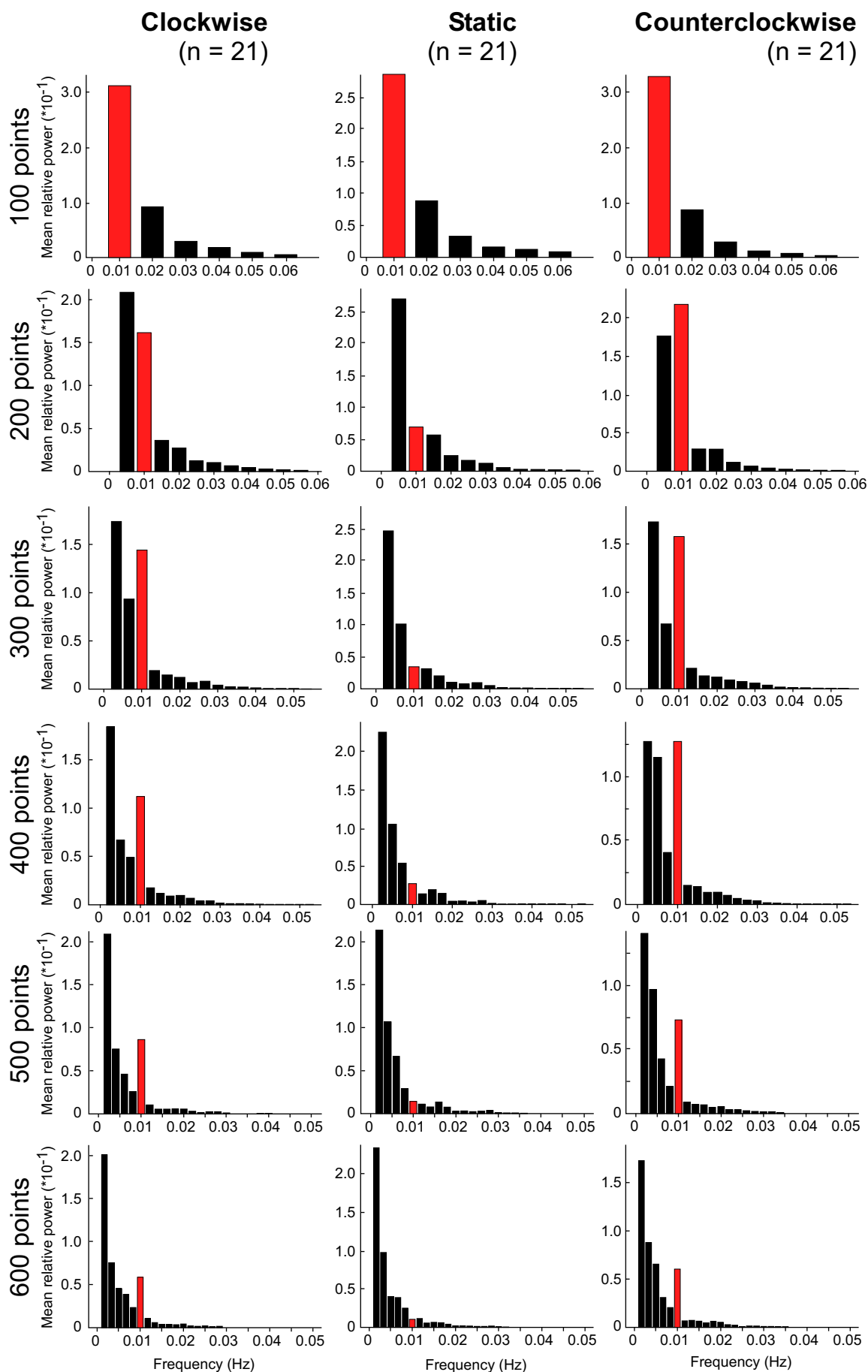
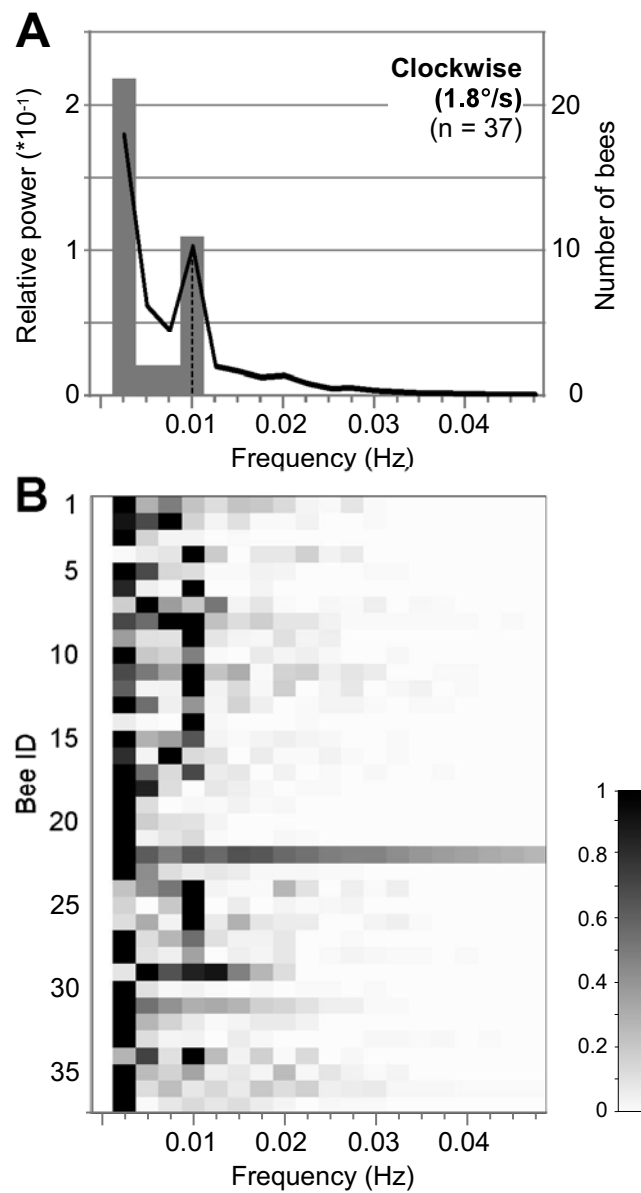


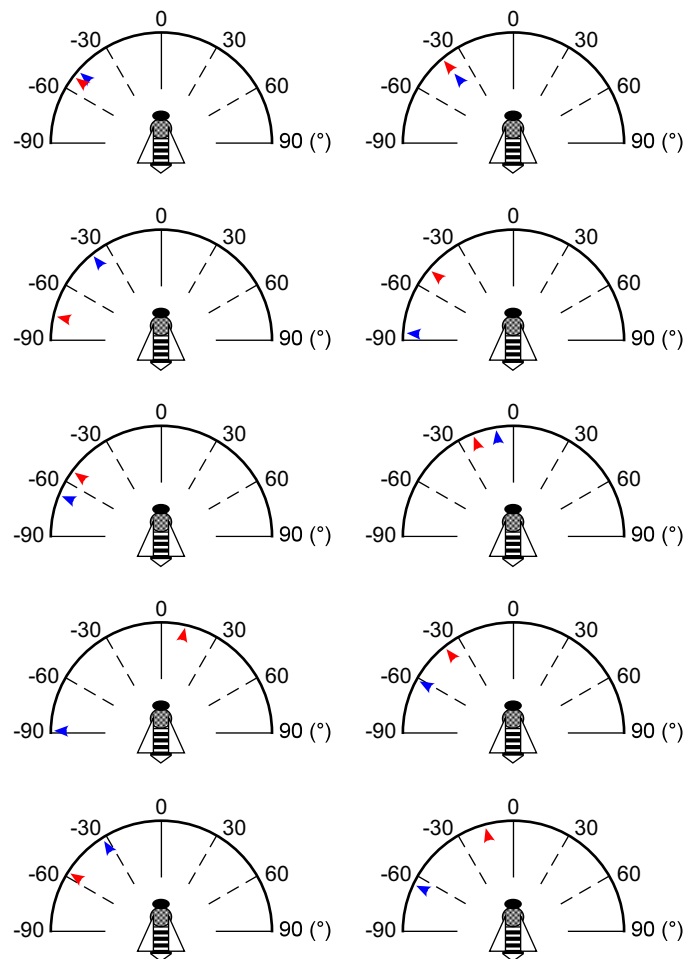
**Fig. S1 Correlations of the torque with the abdominal tip.** **A.** Experimental setup. **B.** Time traces of the torque (blue) and horizontal movement of the abdominal tip (red). **C.** Scatter plots of torque and the position of the abdominal tip. Sixty-three out of 73 flights showed a negative correlation coefficient.



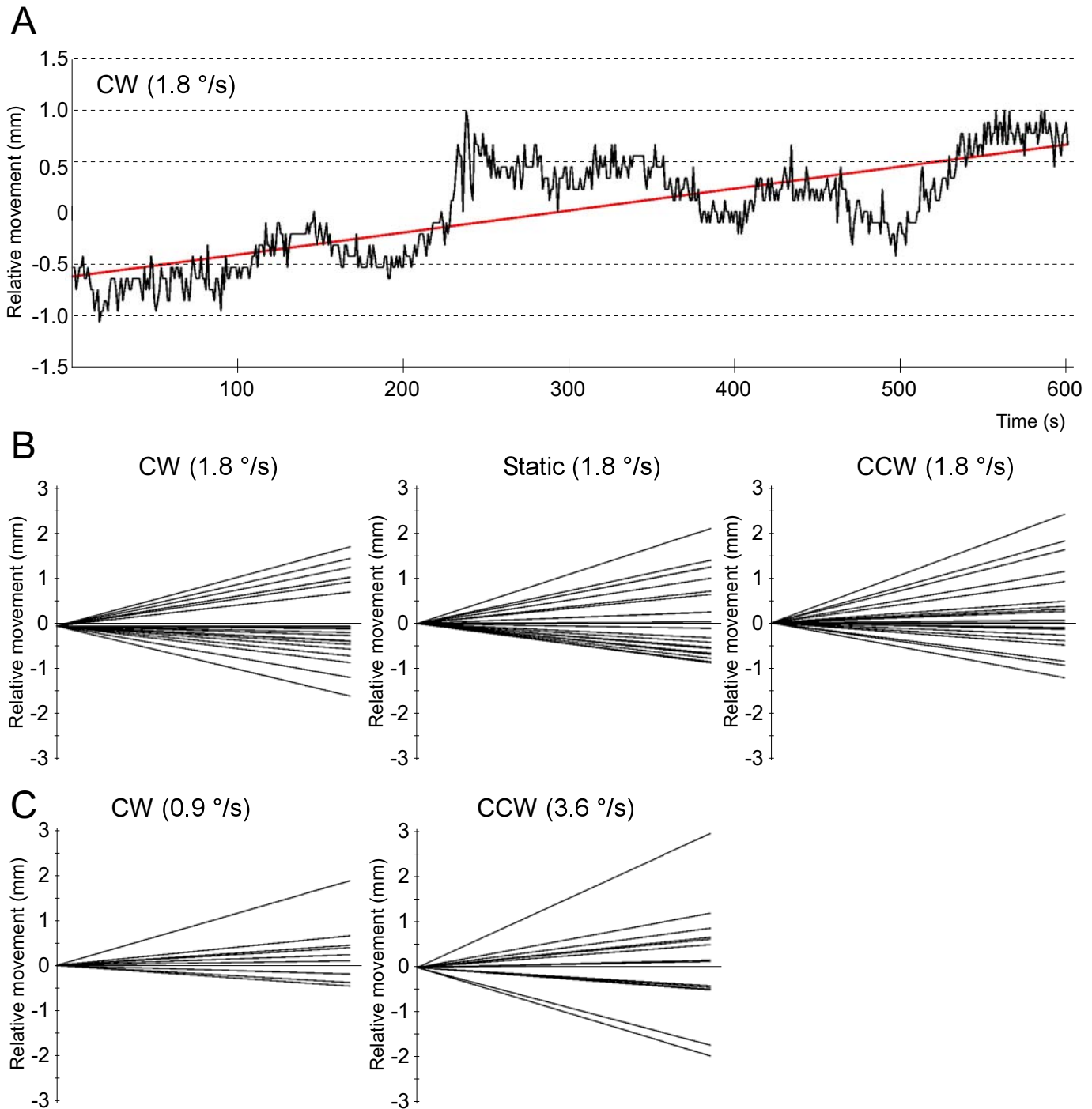
**Fig. S2 Power spectra obtained from different data lengths.** Mean relative PSs were calculated from 21 bees each of which were used for all three simulation conditions: clockwise rotation, counter clockwise rotation, and static condition. 100, 200, 300, 400, 500, and 600 points ( $1 \text{ point} \cdot \text{sec}^{-1}$ ) from the end of measuring were extracted for calculating relative PSs. Because the frequency resolution depends on the data length mathematically, the lowest frequency component (this is defined as a fundamental frequency mathematically) is different among different data-length groups, e.g. 0.01 Hz for 100-points group and 0.002 Hz for 500-points group. The lowest frequency component is large in all cases. On the contrast, 0.01 Hz components (red bars) were large data-length independently only when the polarized filter was rotated. Note that the fundamental frequency was different among data-length.



**Fig. S3 Power spectra of the abdominal movements under the clockwise ( $1.8^\circ \text{ s}^{-1}$ ) stimulus. A.** An averaged power spectrum (black line) and a histogram of the maximum peak in each power spectrum (gray bars) are shown ( $N = 37$ ). Dashed lines indicate the peaks at the stimulus rotation frequency (0.01 Hz). **B.** Heat maps of power spectra (normalized by the maximum power) of all experimental bees shown in A ( $N = 37$ ). Note that the 21 of 37 bees were the same individuals shown in Fig. 3.



**Fig. S4 Preferred e-vector orientations (PEOs) under the clockwise and counterclockwise stimulus.** PEOs of each bee that exhibited polarotaxis both under clockwise (red) and counterclockwise (blue) rotating stimuli ( $1.8^\circ \text{ s}^{-1}$ ) are shown with respect to the bee's body axis ( $N = 10$ , see also Fig. 3).



**Fig. S5 Trends of steering directions.** The trend of the response trajectory was obtained as the slope of a line calculated by linear fitting of the trajectory using the least squares. To compare the trends among individuals (B, C), starting points of the slopes were set at zero. **A.** An example of trajectory of the abdominal tip under the clockwise ( $1.8\text{ }^{\circ}\text{ s}^{-1}$ ) stimulus. The red line indicate the trend of this behavioral response. **B.** Trends of 21 bees for clockwise (CW), static, and counterclockwise (CCW) 600-second stimulus at speed of  $1.8\text{ }^{\circ}\text{ s}^{-1}$ . **C.** Trends of another bee groups for the slow and fast speed under the 600-second clockwise stimulus ( $N = 10$  and  $14$  for  $0.9\text{ }^{\circ}\text{ s}^{-1}$  and  $3.6\text{ }^{\circ}\text{ s}^{-1}$  stimulus, respectively).