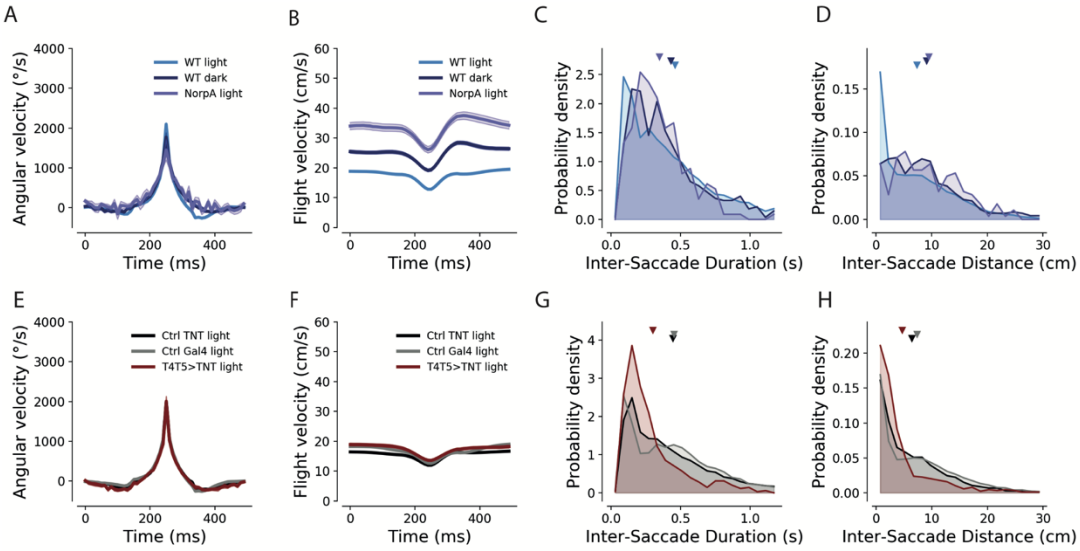

Fig. S1. Saccade characteristics across genotypes and stimulus conditions.
(A) Angular velocity profile (mean ± sem) during a saccade executed in free flight for wild type flies in light (light blue), in dark (dark blue) and NorpA (blind) flies (magenta).
(B) Mean flight velocity (± sem) for same saccades as in (A).
(C) Probability density of inter-saccade duration for all intersaccadic segments in each genotype (same flight trajectories as in (A)). Triangles represent the mean inter-saccade duration for the respective genotype.
(D) Probability density of inter-saccade distance for all intersaccadic segments in each genotype (same flight trajectories as in (A)). Triangles represent the mean inter-saccade distance of all segments for the respective genotype.
(E) Same measurements as in (A) for motion-blind flies (T4T5>TNT depicted in dark red), UAS parental control (black) and Gal4 control (grey).
(F, G and H) Same measurements as in (B), (C) and (D) respectively, for motion blind and parental control flies.

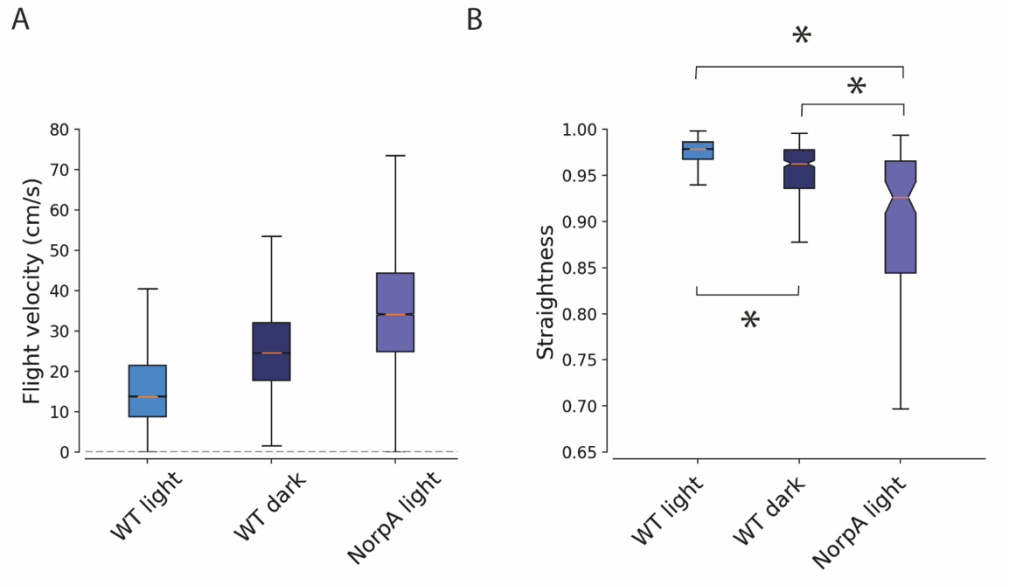

Fig. S2. Free-flight behavior of wildtype flies in the light and in the dark as well as of blind flies.

(A) Flight velocity of wildtype flies in the light (light blue), in the dark (dark blue) and blind flies (magenta). n=1988 trajectories light, n=310 trajectories dark, n=100 trajectories blind flies.

(B) Straightness of long inter-saccade flight segments (250-2000 ms). Significant differences based on a Kolgomorov/Smirnov test ($p<0.0001$, n=4609 segments light, n= 302 segments dark, n=100 segments blind).

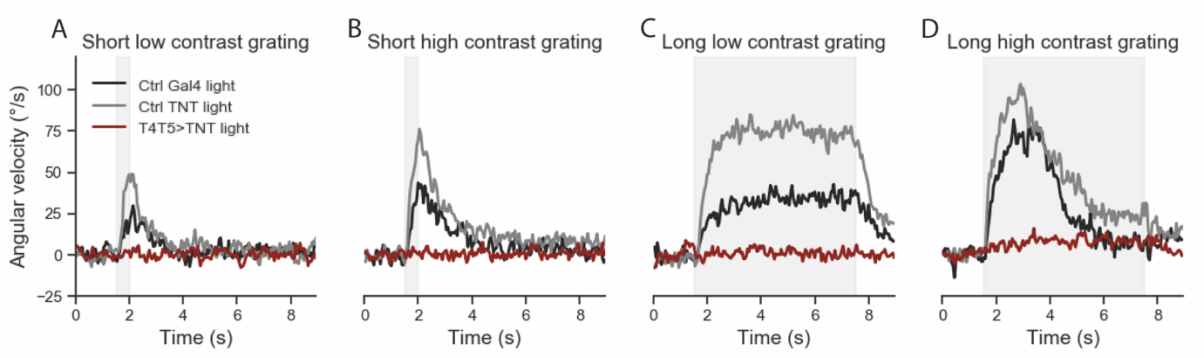

Fig. S3. Motion-blind flies show no optomotor response in tethered walking
Angular velocity of tethered-walking flies during presentation of full-field square wave gratings had a spatial wavelength of λ = 20°, a mean luminance of 11 cd m^{-2} and either high (49%) or low (1.4%) contrast. They moved at a velocity of 20 ° s^{-1} either to the left or to the right and were presented for a short (0.5 s) or a long period of time (6 s). Flies which walked continuously for at least 10 trials were selected and only the trials which had an average walking speed of higher than 0.25 cm·s^{-1} were included in the analysis. Turning speed traces were determined by taking the average over trials and low-pass filtering the resulting trace (τ = 0.1 s in all experiments).
(A) Angular velocity response to short low contrast grating.
(B) Angular velocity response to short high contrast grating.
(C) Angular velocity response to long low contrast grating.
(D) Angular velocity response to long high contrast grating. n=7 motion blind flies (dark red), n=9 for TNT Control (grey), n=4 Gal4 Control flies (black)

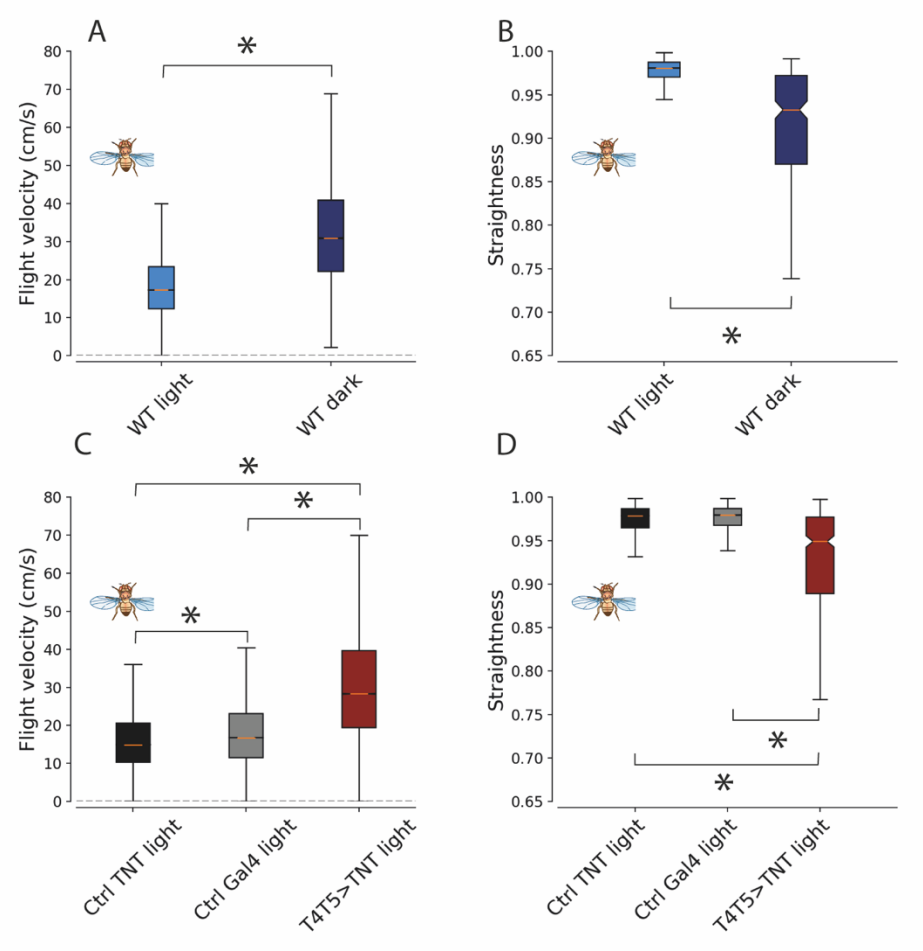

Fig. S4. Free-flight behavior of wing-clipped flies.
(A) Flight velocity of flies in the light and in the dark (n=6773 trajectories light and n= 205 trajectories dark).
(B) Straightness of inter-saccade flight segments (250 – 2000 ms) of wildtype flies. Significant differences based on Kolgomorov/Smirnov test (n=7607 inter-saccade flight segments light and n=241 segments dark $p<0.0001$).
(C) Flight velocity of motion-blind flies and parental controls (TNT Control n=4983 trajectories, Gal4 Control n=3893 trajectories, T4T5>TNT n=734 trajectories).
(D) Straightness of inter-saccade flight segments (250 – 2000 ms) of parental control and T4T5 > TNT flies. Significant differences are based on Kolgomorov/Smirnov test ($p<0.0001$, TNT Control n= 6818 inter-saccade flight segments, Gal4 Control n= 7162 segments, T4T5>TNT n=418 segments).