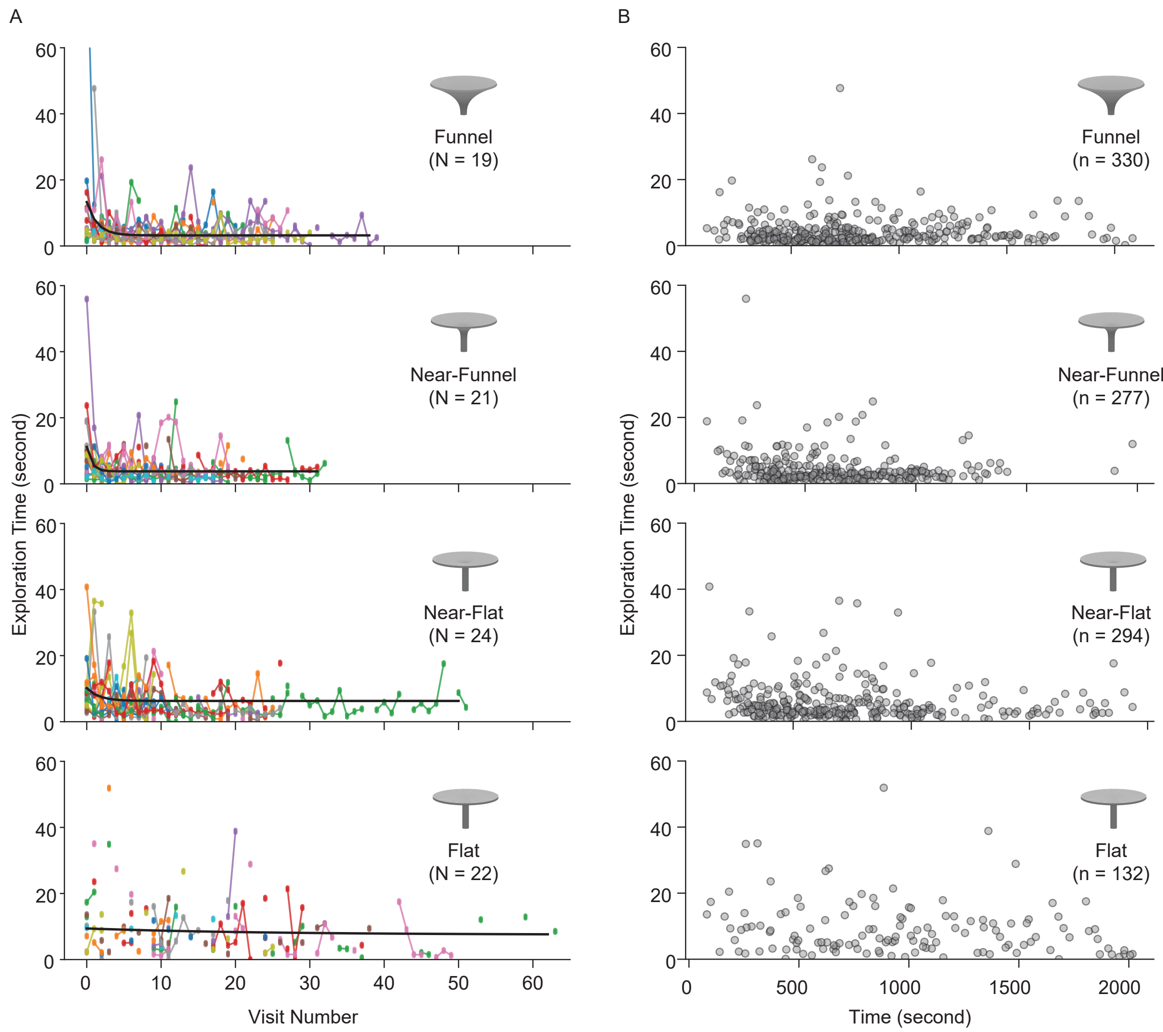


Figure S1: (A) Learning curves for individual moths across all floral shapes are plotted as versus visit number (panel A) and time (panel B). Each color in panel A is for a separate individual. The black solid line is the exponential fit to the data pooled across all moths as shown in Fig 2 in main MS. Each dot in panel B represents a single successful visit.

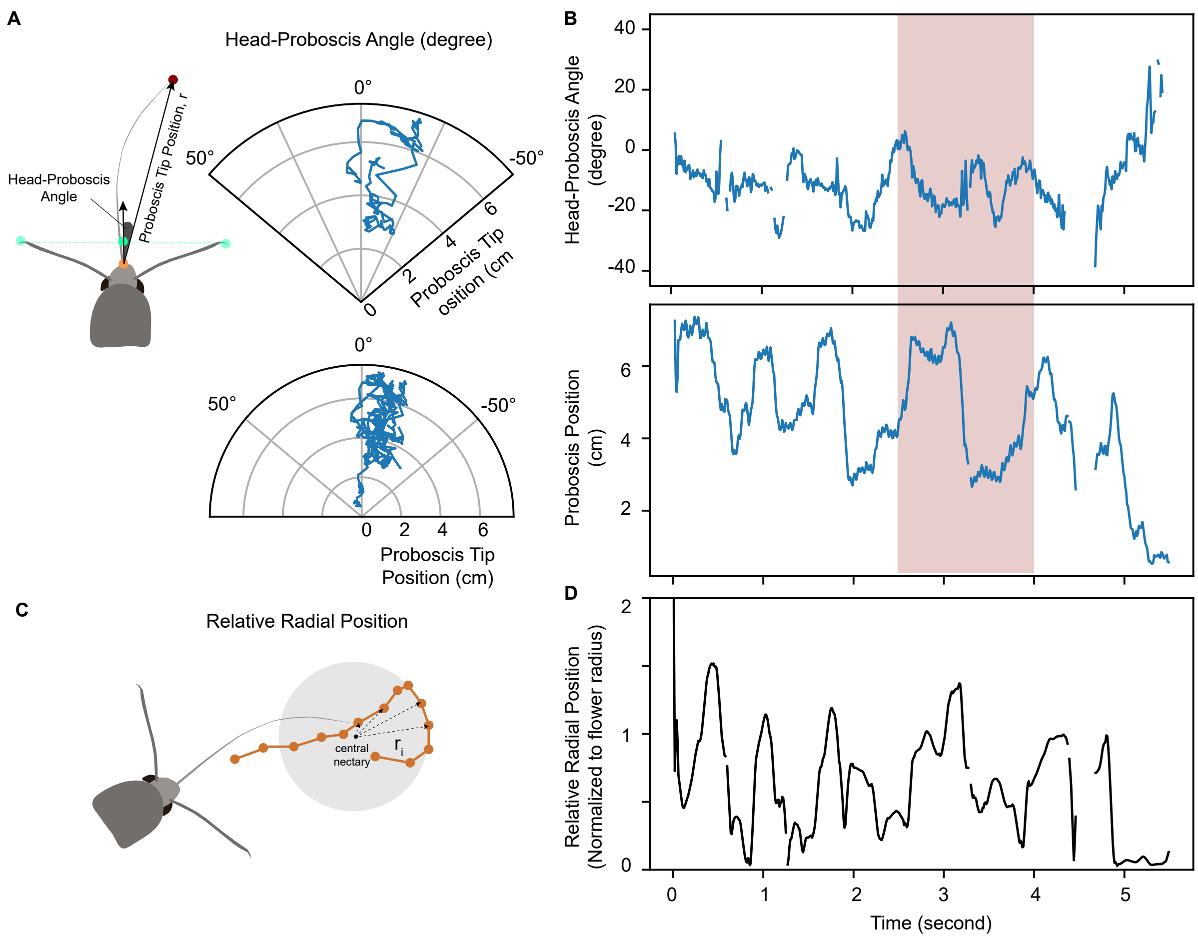


Figure S2: Proboscis mov ement relative to head. A) The cartoon on the left shows how we compute the angle and position of the proboscis tip relative to the head direction vector. The polar plots show the tracks of the proboscis tip relative to the head for a representative moth exploring the flat flower for the first visit. The track on top is a zoomed in view of the bottom track (in blue) B) Both the relative angle between the proboscis tip and head (top) and relative position of the tip from the head (bottom) varies as the moth (same visit as in A) explores the floral surface. The transparent red bar represents the track zoomed in A. C) The cartoon shows how we compute the relative radial position of the proboscis tip (relative to the flower radius) for a representative proboscis track (in orange). D) The proboscis tip position relative to the flower radius for the visit in A shows moths sweeping its proboscis from edge to center - center to edge repeatedly. Gaps in all tracks occur where the tracking error was large and hence not reliable.

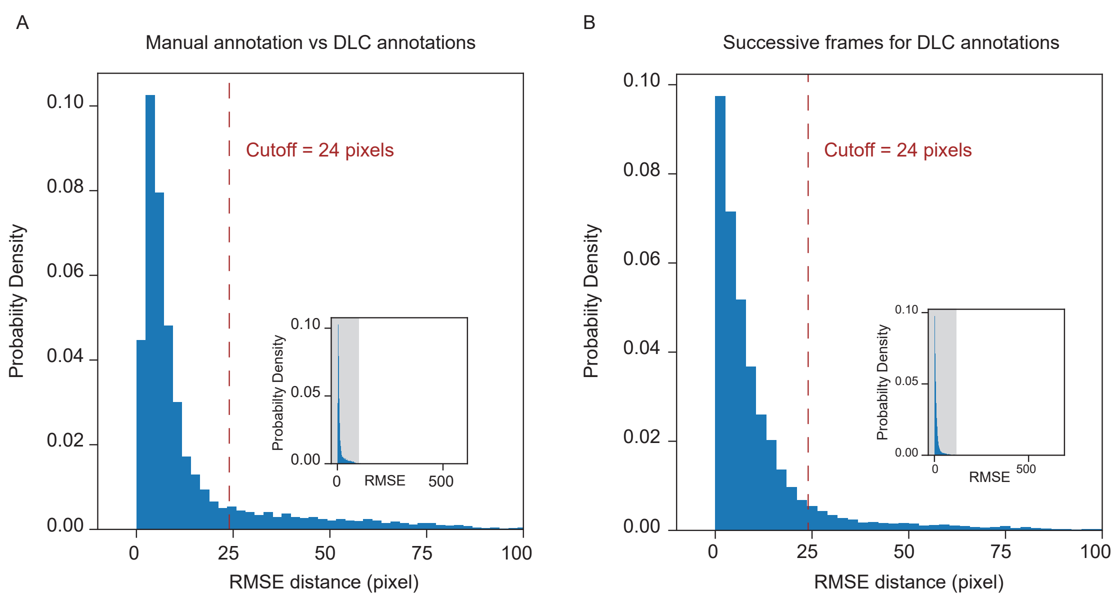


Figure S3: The probability density distribution for the root mean square error (RMSE) distance between the proboscis tip in A) manually annotated versus DeepLabCut (DLC) annotations and in B) successive frames for the DLC annotations are shown here. We manually annotated 6 videos comprising of 10308 frames. Based on the error comparing manual to DLC annotations (shown in A), we used a cut off of 24 pixels. If the distance between the proboscis tip on successive frames with DLC annotations (shown in B) was larger than this cutoff, the tracking data for that frame was dropped. With this cutoff, we could include 87.84% of our data. Inset shows the entire distribution with the grey bar highlighting the region that is zoomed in to visualize the cutoff pixel distance.

(a) Early - Later Visits Within Flowers

flower	**Kolmogorov-Smirnov test p value**
funnel	0.546
near-funnel	$1.05e^2$
near-flat	$2.41e^4$
flat	0.463

(b) Early Visits Across Flowers

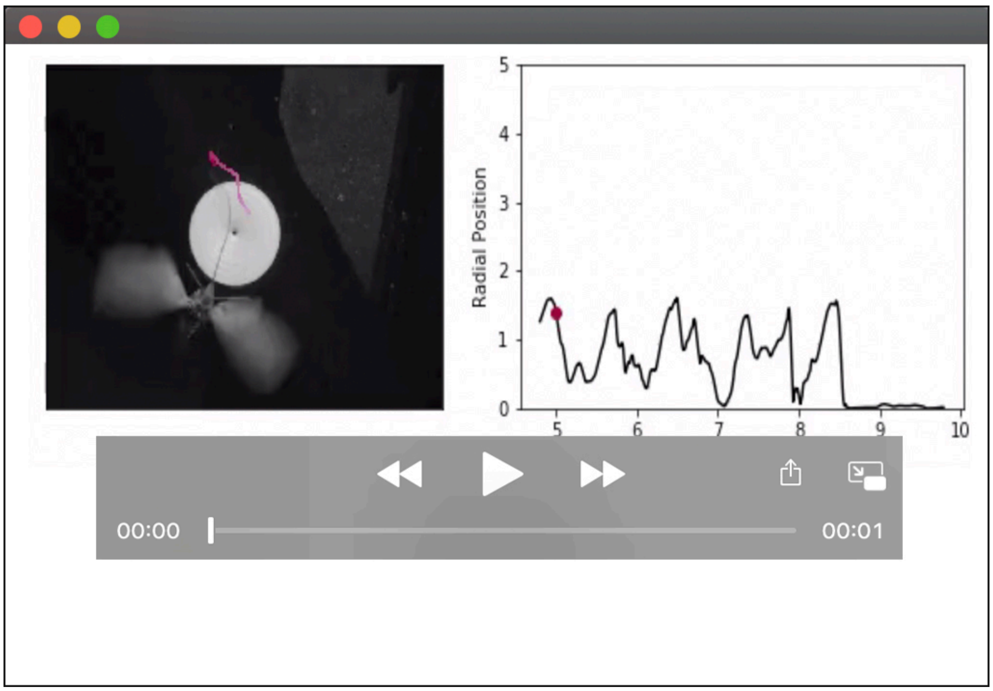
flower pair	**Kolmogorov-Smirnov test p value**	**Kullback-Leibler Divergence**
funnel/near-funnel	0.992	0.001
funnel/near-flat	0.026	0.04
funnel/flat	0.003	0.17
near-funnel/near-flat	0.069	–
near-funnel/flat	0.010	–
near-flat/flat	0.128	–

(c) Later Visits Across Flowers

flower pair	**Kolmogorov-Smirnov test p value**	**Kullback-Leibler Divergence**
funnel/near-funnel	0.063	0.03
funnel/near-flat	0.393	0.005
funnel/flat	0.014	0.54
near-funnel/near-flat	0.342	–
near-funnel/flat	$2.26e^4$	–
near-flat/flat	$2.93e^3$	–

Table S1: Statistics for exploration times across flowers and visitsS

Journal of Experimental Biology • Supplementary information



Movie 1: A moth exploring a slightly curved, near-flat flower with its pro-boscis during it's first visit.