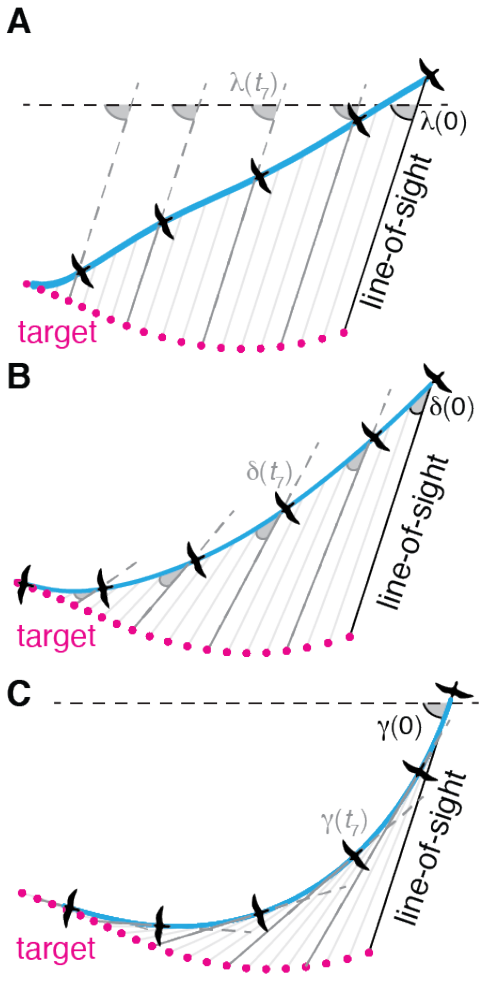

Figure S1. Explanation of the guidance terms, showing the geometry of three chase paths used to describe aerial attack behaviors, adapted from (Brighton et al. 2017). Straight lines mark the line-of-sight bearing (λ) from attacker to target at regular time intervals. (*A*) Shows a parallel navigation course generated by proportional navigation (PN) at high values of the navigation constant N, which tends to nullify the line-of-sight rate (λ is held constant); (*B*) Shows a deviated pursuit generated by PN at $N = 1$, which tends to hold the deviation angle δ constant by turning at a rate equal to the line-of-sight rate; (*C*) Shows a pure pursuit generated by either PN at $N = 1$ or by proportional pursuit (PP) for an initial zero deviation angle, which tends to nullify the deviation angle δ (velocity vector γ is aligned with λ) resulting in in a tail-chase. Either PN at intermediate values of N, or the mixed guidance law (PN+PP), will tend to produce trajectories intermediate between the cases shown.

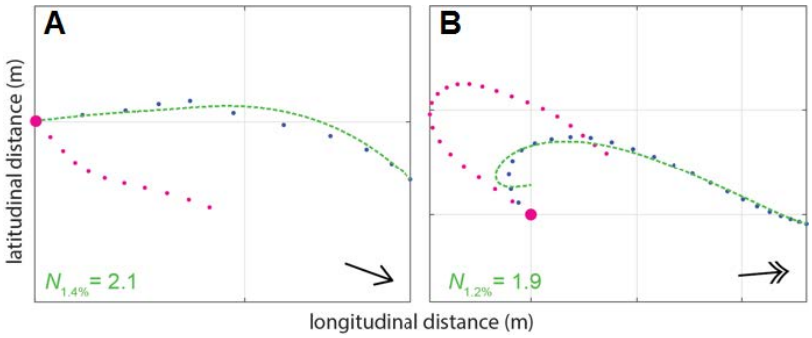

Figure S2. Two-dimensional (2D) attack trajectories for the 2/20 flights from $n = 13$ Gyrfalcons that were not successfully modelled under proportional navigation (PN) guidance. (A,B) The measured trajectories of target (magenta points) and attacker (blue points), overlain with the simulation with the lowest relative error lasting ≥ 2 s (green dashed line), corresponding to Fig. S2A and Fig. S2B in Tables S1 and S2. The corresponding parameter estimate for *N* is displayed on each plot, with a subscript indicating the relative error achieved. Black arrows display mean wind direction; double headed arrows correspond to wind speeds >20 km h^{-1}; gridlines at 10m spacing.

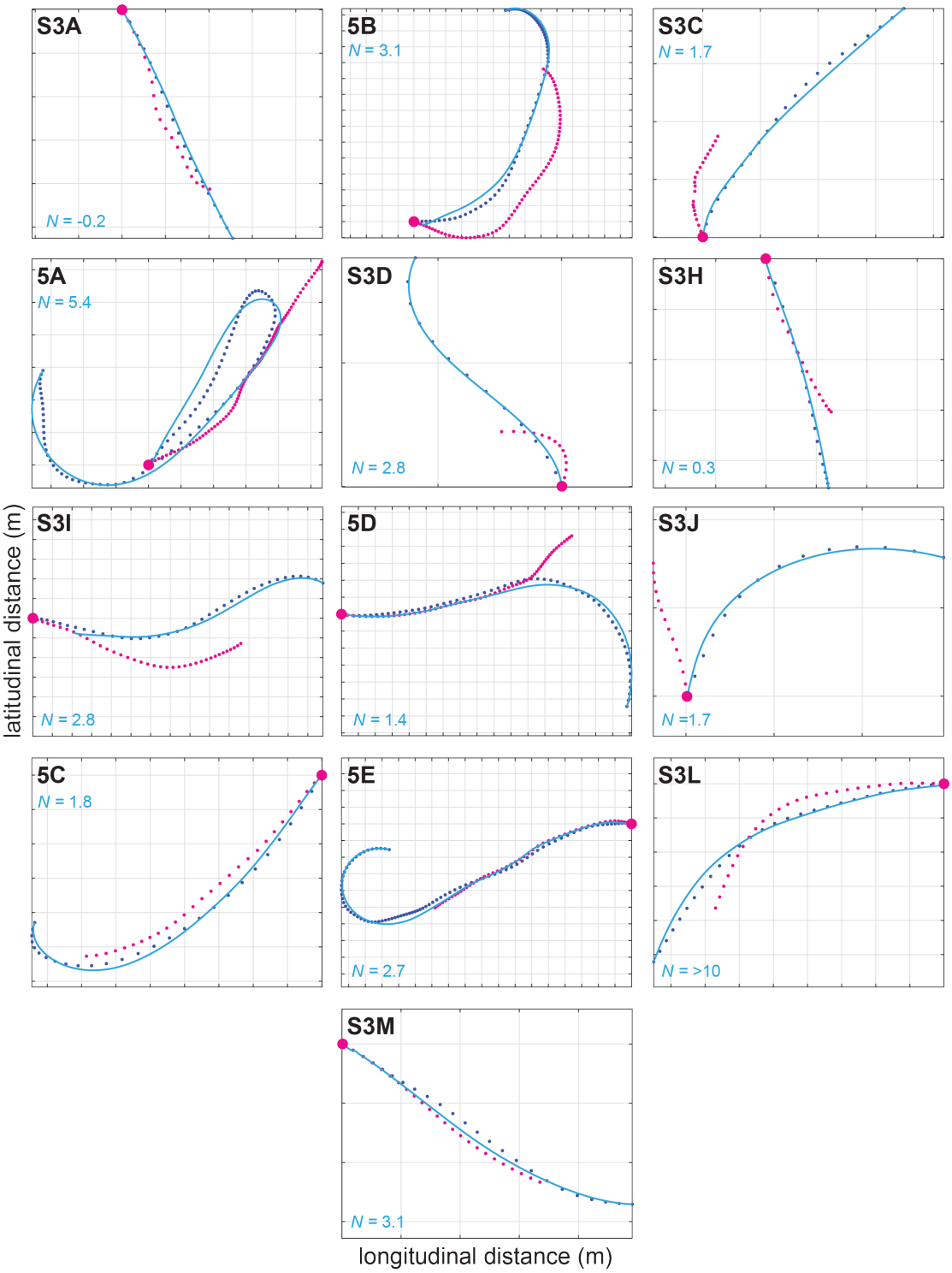

Figure S3. Two-dimensional (2D) attack trajectories for the 13/13 flights from $n = 4$ Peregrines that were successfully modelled under proportional navigation (PN) guidance. Panels show the measured trajectories of the target (magenta points) and attacker (blue points), overlain with the longest simulation fitted to within 1.0% error tolerance (blue lines) in 2D. The corresponding parameter estimate for N is displayed on each plot. Note that the only simulations with values of N falling beneath the 3rd quartile for the Gyrfalcons ($N < 1.4$) coincide with nearly straight sections of flight (panels S3A, S3H), for which parameter estimation is unreliable. Panel labels correspond to the numbering and lettering of the figure panels in the original paper from which the measured trajectory data are drawn. Gridlines at 10m spacing.

Tables

date	bird ID	bird flight	flight	type	pedigree	sex	mass (kg)
10/08/17	10	2nd	Fig.S2A	chase	Gyrfalcon	♀	1.295
10/08/17	8	2nd	Fig.4J	chase	Gyrfalcon	♂	0.939
25/08/17	11	1st	Fig.4K	chase	Gyrfalcon	♀	1.098
25/08/17	13	1st	Fig.4A	dash	Gyrfalcon	♂	0.850
25/08/17	16	1st	Fig.4H	dash	Gyrfalcon	♀	1.179
25/08/17	18	1st	Fig.4B	dash	Gyrfalcon	♀	1.144
25/08/17	17	1st	Fig.4L	chase	Gyrfalcon	♂	0.944
25/08/17	21	1st	Fig.4C	dash	Gyrfalcon	♂	0.871
25/08/17	20	1st	Fig.4D	dash	Gyrfalcon	♀	1.164
25/08/17	22	1st	Fig.4E	dash	Gyrfalcon	♂	0.877
25/08/17	23	1st	Fig.4F	dash	Gyrfalcon	♂	0.858
25/08/17	73	1st	Fig.4I	dash	7/8th Gyr-Saker	♂	0.856
25/08/17	M4	1st	Fig.4G	dash	7/8th Gyr-Saker	♀	1.136
26/08/17	13	2nd	Fig.S2B	dash	Gyrfalcon	♂	0.838
26/08/17	18	2nd	Fig.4M	chase	Gyrfalcon	♀	1.143
26/08/17	17	2nd	Fig.4N	chase	Gyrfalcon	♂	0.937
26/08/17	23	2nd	Fig.4O	chase	Gyrfalcon	♂	0.873
26/08/17	73	2nd	Fig.4P	chase	7/8th Gyr-Saker	♂	0.872
26/08/17	M4	2nd	Fig.4Q	chase	7/8th Gyr-Saker	♀	1.129
26/08/17	13	3rd	Fig.4R	chase	7/8th Gyr-Saker	♂	0.838

Table S1. Details of the $n = 13$ Gyrfalcons used in the 20 flights meeting quality control for accuracy of the GPS data. The letter code for each flight corresponds to the lettering of all applicable figure panels.

date	bird	flight	PP				PN				PN+PP				
			K (s^{-1})	duration (s)	distance (m)	relative error	N	duration	distance (m)	relative error	N	K (s^{-1})	duration (s)	distance (m)	relative error
10/08/17	14	Fig.S2A	0.9	2.0	18.8	0.70	n.s.	n.s.	n.s.	n.s.	-0.3	1.1	5.4	56.5	0.74
10/08/17	1	Fig.4J	0.6	7.8	171.3	0.88	2.8	10.6	212.7	1.04	1.0	0.3	13.6	225.3	1.04
25/08/17	2	Fig.4K	0.1	10.2	107.4	0.99	0.1	6.4	65.7	0.81	-0.1	0.1	10.2	107.4	0.65
25/08/17	4	Fig.4A	1.1	3.2	18.8	1.01	2.1	5.4	28.9	0.86	1.0	0.2	5.4	28.9	0.56
25/08/17	5	Fig.4H	1.0	4	20.9	1.04	0.6	2.6	17.1	1.03	1.0	0.9	4	20.9	0.28
25/08/17	6	Fig.4B	n.s.	n.s.	n.s.	n.s.	5.3	4.2	22.4	0.68	1.5	0.4	4.2	22.4	0.23
25/08/17	7	Fig.4L	-0.1	2.2	14.8	0.43	-0.2	2.2	14.8	0.52	1.4	-1.0	3.4	24.6	0.92
25/08/17	8	Fig.4C	8.8	3.8	35.2	1.01	1.2	5	40.6	0.60	1.6	-0.8	5.2	41.1	0.59
25/08/17	9	Fig.4D	0.2	3.4	27.0	0.81	0.2	3.6	27.6	0.71	0.4	-0.2	3.6	27.6	0.52
25/08/17	10	Fig.4E	n.s.	n.s.	n.s.	n.s.	0.5	3.8	32.2	0.96	0.7	-0.4	3.8	32.2	0.78
25/08/17	11	Fig.4F	n.s.	n.s.	n.s.	n.s.	1.0	4.2	37.9	0.61	1.5	0.3	4.2	37.9	0.51
25/08/17	12	Fig.4I	-0.3	2.4	8.4	0.70	1.4	3.2	14.3	1.04	1.8	1.75	4.0	18.1	0.28
25/08/17	13	Fig.4G	n.s.	n.s.	n.s.	n.s.	1.2	6.4	57.3	0.85	2.2	2.5	7	59.2	0.65
26/08/17	4	Fig.S2B	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	1.6	-1.8	3.6	31.3	0.45
26/08/17	6	Fig.4M	1.2	6	63.2	1.04	1.4	8.2	86.9	0.35	1.8	-0.2	8.4	89.8	0.53
26/08/17	7	Fig.4N	0.2	3.2	21.6	0.68	0.2	3.2	21.6	0.81	0.0	0.2	3.2	21.6	0.67
26/08/17	9	Fig.4O	1.9	2.6	10.0	0.64	1.4	2.6	10.0	0.41	1.2	0.22	2.6	10.0	0.42
26/08/17	12	Fig.4P	1.7	13.6	162.6	1.00	1.0	12	148.3	0.51	1.0	0.2	18.8	202.4	1.01
26/08/17	13	Fig.4Q	2.3	13	144.0	0.28	1.1	13.2	145.9	1.01	-	28.6	14.6	157.5	0.68
26/08/17	4	Fig.4R	n.s.	n.s.	n.s.	n.s.	1.2	14.2	143.2	0.85	1.3	-0.2	14.2	143.2	0.68

Table S2. Results of the two-dimensional (2D) guidance model fitting for the sample of 20 flights from $n = 13$ Gyrfalcons, under proportional pursuit (PP), proportional navigation (PN), and mixed PN+PP guidance. Flights marked "n.s." are those which could not be fitted to within the specified 1.0% error tolerance for ≥ 2 s. The letter code for each flight corresponds to the lettering of all applicable figure panels. See text for details and definitions.

date	bird	flight	PP				PN				PN+PP				
			K (s^{-1})	duration (s)	distance (m)	relative error	*N*	duration (s)	distance (m)	relative error	*N*	*K* (s^{-1})	duration (s)	distance (m)	relative error
09/05/14	Le	Fig.S3,S3A	-0.2	3.6	58.5	0.51	-	3.6	58.5	0.44	0.3	0.7	8.8	121.6	1.00
28/04/14	Le	Fig.S3,5B	-0.5	3.0	47.7	0.68	3.1	13.2	195.7	1.01	2.2	0.3	14.8	209.0	0.63
22/08/16	Rn	Fig.S3,S3C	-0.6	2.8	35.0	0.46	1.7	4.2	53.7	0.99	1.9	0.6	7.0	88.0	0.90
22/08/16	Mo	Fig.S3,5A	-0.3	5.0	55.7	0.90	5.4	18.4	199.5	1.01	2.9	0.8	6.8	67.1	0.66
23/08/16	Ra	Fig.S3,S3D	n.s.	n.s.	n.s.	n.s.	2.8	2.6	23.3	0.44	8.0	-5.6	4.6	46.4	0.24
08/09/16	Rn	Fig.S3,S3H	0.4	3.4	47.6	0.55	0.3	3.2	47.2	0.43	1.6	3.5	3.6	47.9	0.82
09/09/16	Rn	Fig.S3,S3I	0.0	2.2	41.7	0.87	2.8	7.4	156.7	0.77	1.3	0.2	7.8	165.0	0.90
09/09/16	Ra	Fig.S3,5D	0.9	12.2	235.4	0.86	1.4	11.4	223.5	0.92	0.7	0.5	14.2	251.5	0.30
12/09/16	Rn	Fig.S3,S3J	n.s.	n.s.	n.s.	n.s.	1.7	2.6	37.7	0.87	0.6	0.2	20.0	89.5	0.86
14/09/16	Ra	Fig.S3,5C	1.3	5.2	113.7	0.68	1.8	5.4	115.7	0.87	0.8	0.3	12.2	201.4	1.00
15/09/16	Rn	Fig.S3,5E	0.8	14.2	195.8	0.96	2.7	17.6	242.2	0.62	3.4	-0.1	17.6	242.2	0.52
15/09/16	Ra	Fig.S3,S3L	-0.2	2.6	51.1	0.06	>10	5.4	105.8	1.00	1.0	0.6	8.8	149.1	1.01
15/09/16	Mo	Fig.S3,S3M	-0.1	3.6	44.9	0.77	3.1	4.6	56.9	0.90	2.6	-2.2	5.0	61.1	0.54

Table S3. Results of the two-dimensional (2D) guidance model fitting for the sample of 13 flights from $n = 4$ Peregrines, under proportional pursuit (PP), proportional navigation (PN), and mixed PN+PP guidance. Flights marked "n.s." are those which could not be fitted to within the specified 1.0% error tolerance for ≥ 2 s. The letter code for each flight corresponds to the lettering of all applicable figure panels. See text for details and definitions.