



Figure S1: Beak and wingtip trajectories throughout the upward-directed escape maneuver of a pied flycatcher with simulated molt gaps. The trajectories are shown in the world reference from a top view (A), front view (B), perspective view (C) and side view (D). Beak movement is in green, left wingtip movement in blue and right wingtip movement in red. The crosses show the Kalman smoothed position at each video frame, whereas the corresponding back circles show the non-filtered position.

Table S1: Effects of treatments on several flight performance components. Statistics are given for the point of exclusion of each term from the model. Significant *p*-values are marked in bold, significance was assessed after a Holm-Bonferroni correction.

Gap width	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	37.41	48.59	<0.01
Treatment (control)	5.24	0.17				
Treatment (molt)	3.55	0.18				
Normalized force	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	37.89	0.69	0.41
Treatment (control)	2.16	0.07				
Treatment (molt)	2.08	0.07				
Second-moment-of-area	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	35.72	20.61	<0.01
Treatment (control)	1.61	0.05				
Treatment (molt)	1.27	0.05				
Flight speed	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	38.48	0.94	0.34
Treatment (control)	2.52	0.05				
Treatment (molt)	2.45	0.05				
Wing speed	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	35.08	4.28	0.05
Treatment (control)	6.52	0.16				
Treatment (molt)	7.00	0.16				
Wing angle-of-attack	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	33.20	15.78	<0.01
Treatment (control)	19.39	0.77				
Treatment (molt)	23.73	0.77				
Tail speed	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	38.46	1.89	0.18
Treatment (control)	3.57	0.09				
Treatment (molt)	3.38	0.10				
Tail spread	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment				37.77	0.15	0.70
Treatment (control)	5.34	0.33				
Treatment (molt)	5.15	0.34				
Tail angle-of-attack	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	38.47	0.47	0.50
Treatment (control)	30.79	2.90				
Treatment (molt)	33.69	3.05				

Table S2: Results of the multiple regression analysis testing the effect of various kinematic variables on the normalized force. Model selection was performed via backwards selection, dropping non-significant terms in each step. Statistics are given for the point of exclusion of each term from the model.

Normalized force	Estimate	s.e.	ndf	ddf	F-test	p-value
Second-moment-of-area	0.04	0.09	1.00	111.14	0.18	0.67
Flight speed	0.53	0.14	1.00	99.62	13.98	<0.01
Wing speed	0.08	0.03	1.00	126.86	6.12	0.01
Wing angle-of-attack	0.00	0.01	1.00	121.94	0.44	0.51
Tail speed	0.07	0.02	1.00	120.81	16.70	<0.01
Tail spread	0.07	0.02	1.00	90.59	0.69	0.41
Tail angle-of-attack	0.00	0.00	1.00	114.72	0.50	0.48

Table S3: Outcomes of the principal component analysis including loadings of morphology variable S_2 , performance variable normalized force, and wing kinematics variables angles-of-attack and wing speed. We retained components that explained a variance larger than 1 (PC1 to 3).

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9
Standard deviation	1.42	1.32	1.11	0.99	0.87	0.82	0.74	0.62	0.50
Proportion of Variance	0.24	0.20	0.14	0.11	0.09	0.08	0.06	0.04	0.03
Cumulative Proportion	0.24	0.44	0.58	0.70	0.79	0.86	0.93	0.97	1.00
Variance explained	2.02	1.73	1.24	0.98	0.76	0.67	0.54	0.38	0.25
Gap width	-0.30	0.10	0.44	-0.11	0.04	-0.77	0.26	0.08	-0.14
Normalized Force	-0.48	-0.19	-0.08	-0.34	-0.15	0.36	0.67	-0.06	0.09
Second-moment-of-area	-0.28	0.32	0.34	0.14	-0.56	0.15	-0.26	-0.53	0.01
Flight speed	-0.52	0.21	-0.29	0.16	0.42	0.11	-0.16	-0.08	-0.59
Wing speed	-0.33	-0.08	-0.45	0.24	-0.54	-0.22	-0.17	0.50	0.10
Wing angle-of-attack	0.11	-0.43	-0.45	-0.19	-0.13	-0.39	-0.05	-0.61	-0.14
Tail speed	-0.14	0.41	-0.20	-0.72	0.12	-0.07	-0.35	0.04	0.34
Tail spread	-0.08	-0.52	0.37	-0.40	-0.14	0.17	-0.41	0.25	-0.39
Tail angle-of-attack	0.42	0.42	-0.15	-0.26	-0.38	0.03	0.26	0.14	-0.57

Table S4: Effects of treatment on the principal components 1 to 3. Statistics are given for the point of exclusion of each term from the model.

PC1	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	38.45	6.88	0.01
Treatment (control)	-0.42	0.24				
Treatment (molt)	0.49	0.25				
PC2	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	38.00	5.80	0.02
Treatment (control)	0.28	0.20				
Treatment (molt)	-0.43	0.21				
PC3	Estimate	s.e.	ndf	ddf	F-test	p-value
Treatment			1.00	37.83	26.32	<0.01
Treatment (control)	0.62	0.15				
Treatment (molt)	-0.50	0.16				



Movie 1: Three-camera stereoscopic video of a Pied Flycatcher from the *control* group performing an upward-directed escape flight maneuver. The video was recorded at 200 frames per second and replayed at 10 frames per second, and is thus slowed down 20 times.



Movie 2: Three-camera stereoscopic video of a Pied Flycatcher from the *molt* group performing an upward-directed escape flight maneuver. The video was recorded at 200 frames per second and replayed at 10 frames per second, and is thus slowed down 20 times.