

Supplementary Material

Songbirds use scent to navigate: an experiment in homing great tits (*Parus major*)

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Supplemental Table 1: Shows the results of a multivariate GLM with perch number, perch height, maximal perch height, and time until departure as dependent variables and treatment (T = olfactory treatment (n = 55 birds) and C = sham treatment (n = 53 birds)) as the independent factor. The variables describe behaviours immediately after individuals are released until its departure and include: i) perch number = the number of perches used before departure, ii) perch height = the average height of the perches used before departure, iii) maximal perch height = the highest perch used before departure and iv) time spent at the releasing site until departure. The overall model revealed no significant result (Wilks' $\lambda = 0.961$; $F = 1.039$; $df = 4, 103$; $p = 0.391$).

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	perch number	1293,540	1	1293,540	170,522	,000
	perch height	2505,654	1	2505,654	257,248	,000
	maximal height	4938,081	1	4938,081	249,731	,000
	time until departure	301732,910	1	301732,910	92,375	,000
Treatment (T/C)	perch number	,763	1	,763	,101	,752
	perch height	10,773	1	10,773	1,106	,295
	maximal perch height	22,248	1	22,248	1,125	,291
	time until departure	1138,614	1	1138,614	,349	,556
Total	perch number	2100,000	108			
	perch height	3543,669	108			
	maximal perch height	7045,750	108			
	time until departure	648525,000	108			

$R^2 = ,001$ (Adjusted $R^2 = -,008$) for perch number

$R^2 = ,010$ (Adjusted $R^2 = ,001$) for perch height

$R^2 = ,011$ (Adjusted $R^2 = ,001$) for maximal perch height

$R^2 = ,003$ (Adjusted $R^2 = -,006$) for time until departure

Supplemental Table 2: Data

ringnb	date cap	time cap	time release	distance	obs date	return time	return time h	returntime min.	t/c	yes no ret	perching nb	average height perch meter	max searching height	time oos sec.	bm	tas	tail	wing	Residuals bm/wing	Residuals bm/tars condition	Comp1/orientation behaviour
C2M6654	06.02.14	9:15	11:32	500					c	n	0	1,00	1	10	16,4	19,22	56,5	71,5	-1,048333564	-1,728613626	1,944393495
C2M6655	06.02.14	9:15	11:31	500	13.02.14	14:40		171,09	t	y	0	1,00	1	10	18,5	19,96	62	76,5	-0,251347446	-0,084214614	1,944393495
C2M6656	06.02.14	9:15	na	500					t	n	0	1,00	na	17,7	19,75	62,5	75,5	-0,790744659	-0,79072441		
C2M6657	06.02.14	9:15	11:30	500	09.02.14	12:33	73,03	4383	c	y	4	5,25	8	21	18,1	19,97	62	75	-0,260443281	-0,490371384	-0,004388144
C2M6658	06.02.14	9:15	11:26	500	06.02.14	14:35	3,09	189	c	y	8	8,44	12	33	16,5	19,67	60,5	73	-1,339237728	-1,905668281	-1,573732373
C2M6659	06.02.14	9:15	11:27	500	06.02.14	15:00	5,45	345	t	y	3	8,00	11	21	18,9	19,61	64,5	76	0,278953942	0,53127234	-0,156612783
C2M6661	06.02.14	9:15	11:28	500	06.02.14	13:55	2,27	147	c	y	2	3,50	4	23	17,7	19,86	59	75	-0,660443281	-0,822646913	0,967844452
C2M6662	06.02.14	11:15	12:20	500	08.02.14	15:56	51,36	3096	t	y	5	4,40	6	24		20,17	60	76,5			-0,008368910
C2M6671	07.02.14	9:30	12:30	500	13.02.14	9:10	140,4	8440	c	y	0	1,00	1	5	14,4	19,43	58,5	73	-3,439237728	-3,857905798	1,988982899
C2M6672	07.02.14	9:30	12:31	500	11.02.14	11:41	95,1	5710	c	y	0	1,00	1	5	16,8	19,9	57,5	73,5	-1,169539117	-1,747273993	1,988982899
C2M6673	07.02.14	9:30	12:40	500	13.02.14	14:41	146,01	8761	t	y	2	2,50	3,5	34	18	20,23	64,5	77,5	-1,011950222	-0,750447406	0,934473645
C2M6674	07.02.14	9:30	12:30	500					t	n	7	5,93	11	44	19,7	20,69	60,5	77	0,818351166	0,666341169	-1,306246646
C2M6675	07.02.14	10:00	12:36	500					t	n	5	10,80	15	51	20,5	21,05	65,5	76	1,878953942	1,244697445	-1,414217563
C2M6676	07.02.14	10:00	12:37	500	07.02.14	15:30	2,53	173	c	y	0	1,00	1	2	18,5	20,42	65	77	-3,81648834	-0,367426038	2,015736542
C2M6677	07.02.14	10:00	12:32	500	16.02.14	9:55	213,23	12803	t	y	7	8,29	12	79	18,7	20,26	67	75	0,339556719	-0,068917717	-1,747824237
C2M6678	07.02.14	10:00	12:38	500	09.02.14	8:31	43,53	2633	t	y	2	2,50	3	10	14,7	20,99	64,5	79,5	-4,833155775	-4,518361934	1,213228665
C2M6679	07.02.14	10:00	12:41	500					c	n	10	6,00	10	120	17,8	19,61	59,5	74,5	-0,430141893	-0,56872766	-2,562945777
C2M6680	07.02.14	10:00	12:35	500					c	n	0	1,00	1	2	18,1	20,55	61,5	76,5	-0,651347446	-0,84746405	2,015736542
C2M6681	07.02.14	10:00	12:34	500					t	n	1	2,00	2	21	17,5	18,69	60,5	72,5	-0,20893634	-0,30230481	1,480714392
C2M6682	07.02.14	10:00	12:34	500					c	n	1	4,00	4	6	18,5	20,17	64,5	73	0,660762272	-0,213506786	1,355579077
C2M6683	07.02.14	10:00	12:45	500					t	n	0	1,00	1	3	18,2	20,19	62	77	-0,681648834	-0,525820326	2,006818661
C2M6684	07.02.14	10:00	12:39	500	17.02.14	8:30	235,51	14151	c	y	7	5,93	10	49	15,1	18,2	51,5	69	-1,696826623	-2,400623075	-1,221384287
C2M6685	07.02.14	13:30	14:54	500	12.02.14	14:08	119,14	7154	t	y	2	3,25	3,5	37	20,9	20,09	61,5	78,5	-0,447447001	2,235747375	0,907720003
C2M6686	07.02.14	13:30	15:06	500					c	n	0	1,00	1	4	17,9	19,29	60	71	0,581967823	-0,271711017	1,997900780
C2M6687	07.02.14	13:30	15:03	500	11.02.14	10:28	91,25	5485	t	y	4	2,88	5	28	19,12	20,60	60	75,5	0,009255331	0,433954075	0,321541981
C2M6688	07.02.14	13:30	na	500					na	n	4	1,00	na	19,8		60	73,5	1,430460883	0,926607248		
C2M6689	07.02.14	13:30	15:01	500					c	n	0	1,00	1	3	20,1	19,65	66,5	76,5	1,348652554	1,70664526	2,006818661
C2M6690	07.02.14	13:30	14:59	500	12.02.14	9:40	114,41	6881	t	y	4	6,00	8	43	19,1	20,34	64	78,5	-0,172552999	0,281828122	-0,200581521
C2M6691	07.02.14	13:30	14:57	500					c	n	0	1,00	1	3	17,3	20,92	63	76,5	-1,451347446	-1,875264544	2,006818661
C2M6692	10.02.14	9:10	9:45	500					t	n	8	7,56	13	85	19,2	20	59	78,5	0,072552999	0,591158306	-2,166913937
C2M6693	10.02.14	10:05	11:05	500	12.02.14	14:00	50,55	3055	c	y	5	6,40	10	40	17,3	19,26	60	72,5	-0,40893634	-0,853240706	-0,688862057
C2M6694	10.02.14	10:30	11:04	500					t	n	2	6,00	7	19	17,5	19,51	57	71,5	0,051666436	-0,807159959	0,615160684
C2M6695	10.02.14	10:30	11:07	500					c	n	0	1,00	1	3	17,3	19	57,5	72,5	-0,40893634	-0,693164684	2,006818661
C2M6696	10.02.14	11:10	12:15	500	12.02.14	9:10	44,55	2695	c	y	5	1,90	3	28	17,7	19,27	62	73	-0,139237728	-0,459397476	0,344314857
C2M6697	10.02.14	11:10	12:30	500					t	n	7	7,86	12	42	16,8	19,85	59,5	74,5	-1,430141893	-1,716940143	-1,417862648
C2M6698	10.02.14	11:10	12:27	500	11.02.14	10:28	22,01	1321	c	n	3	1,00	1,5	74	18,59	18,59	59	76	0,321046058	0,555282891	0,600531289
C2M6699	10.02.14	11:10	12:32	500	11.02.14	15:00	26,28	1588	t	y	3	0,17	0,5	115	18,4	20,19	61	78,5	-0,872552999	-0,325820326	0,364349941
C2M6700	10.02.14	11:10	12:20	500	12.02.14	13:03	48,43	2923	c	y	6	4,33	5,5	325	18,8	20,1	61	76,5	0,048652554	0,129590605	-2,864055794
C2M6701	10.02.14	11:10	12:18	500					t	n	1	5,00	5	32	19,5	19,58	60,5	75	1,139556719	1,14974265	0,994262413
C2M6702	10.02.14	12:15	12:20	500	25.02.14	15:14	362,54	21774	t	y	1	5,00	5	33	19,8	19,81	62,5	74	1,700159495	1,308136938	0,985344532
C2M6703	10.02.14	12:15	12:42	500					c	n	7	10,43	15	70	18,3	19,08	61,5	72	0,721365048	0,257581156	-2,055918601
C2M6704	10.02.14	12:15	12:48	500	12.02.14	9:40	44,52	2692	t	y	0	1,00	1	2	19,8	20,14	59,5	75	1,439556719	1,104963524	2,015736542
C2M6705	10.02.14	13:00	14:27	500	11.02.14	9:35	19,08	1148	c	y	3	4,00	5	47	20,2	19,33	66,5	78	1,05774839	2,003661903	0,388232898
C2M6706	10.02.14	13:00	14:35	500					c	n	0	1,00	1	4	17,5	19,03	62	75	-0,860443281	-0,511634994	1,997900780
C2M6707	10.02.14	13:00	14:33	500					t	n	0	1,00	1	3	18,9	19,63	61	73,5	0,930460883	0,5189588	2,006818661
C2M6708	10.02.14	13:00	14:37	500	16.02.14	10:20	139,53	8397	t	y	5	2,90	4	38	18,3	19,88	66,5	76,5	-0,451347446	-0,234960453	0,125684286
C2M6709	10.02.14	13:20	14:31	500	12.02.14	10:45	44,14	2654	c	y	3	3,50	4	34	19,5	20,24	57	76,5	0,748652554	0,743395823	0,636317112
C2M6710	10.02.14	13:00	14:29	500	18.02.14	14:30	192,01	11521	t	y	0	1,00	1	3	17,1	19,51	58	72,5	-0,478634952	-1,207159959	2,006818661
C2M6711	14.02.14	13:30	14:30	500					t	n	3	4,67	6	143	19,6	20,6	61,5	74,5	1,369858107	0,61721521	-0,597335420
C2M6712	14.02.14	13:30	15:27	500					t	n	0	1,00	1	2	18,1	18,39	64	75	-0,260443281	0,482398293	2,015736542
C2M6713	14.02.14	13:30	15:25	500	16.02.14	14:25	47	2820	c	y	0	1,00	1	2	18,9	19,28	62	74,5	0,669858107	0,734445753	2,015736542
C2M6714	14.02.14	13:30	17:10	500					t	n	3	3,00	3,5	118	18,5	19,13	60,5	73,5	0,530460883	0,426797305	-0,050758992
C2M6715	14.02.14	13:30	16:04	500					c	n	8	4,75	10	76	18,3	19,21	58,9	70	1,242570601	0,177543144	-1,698297719
C2M6716	14.02.14	15:10	16:06	500					c	n	2	4,00	4	11	19,1	19,83	63	75	0,739556719	0,595823398	1,074859021
C2M6717	14.02.14	15:40	12:59	500					c	n	1	3,00	3	120	19,8	19,73	58	72,5	0,29106366	1,357391099	0,468392431
C2M6718	14.02.14	15:40	13:05	500					t	n	3	5,50	10	300	18,1	18,43	57,5	71,5	0,651666436	0,457771212	-2,515249756
C2M6719	14.02.14	16:20	12:57	500					c	n	8	2,63	8	117	17,7	19,55	60,5	75	-0,660443281	-0,631787039	-1,222494369
C2M6720	15.02.14	14:00	14:30	500					c	n	7	3,50	4	237	19,8	19,43	65	78,5	-0,472552999	0,542094202	-2,121235292
C2M6721	15.02.14	14:50	15:27	500	18.02.14	11:30	68,03	4083	c	y	9	9,00	12	120	19,2	20,13	60,5	77,5	0,188049778	0,511120295	-2,585718652
C2M6722	15.02.14	14:50	15:25	500					t	n	8	8,									

C2M6749	23.02.14	10:55	1500				c	n	7	6,71	9	132	21	21,35	66,5	78,5	1,727447001	1,559994342	-1,832116628
C2M6750	24.02.14	13:15	1500				t	n	5	4,50	8	46	18,5	20,5	63,5	76,5	-0,251347446	-0,416680199	-0,463465815
C2M6751	24.02.14	13:19	1500				c	n	3	8,67	12	31	17	19,61	63	75	-1,360443281	-1,36872766	-0,375243354
C2M6752	24.02.14	10:01	1500				t	n	3	6,00	10	45	19,8	20,06	63,5	78	0,65774839	1,154217685	-0,241190158
C2M6753	24.02.14	10:00	1500	02.03.14	11:31	145,31	c	y	6	1,50	3	70	16,8	21,27	62	76,5	-1,951347446	-2,590751497	-0,266366787
C2M6755	24.02.14	10:37	1500				c	n	4	12,67	12	44	18,4	19,43	58	73,5	0,430460883	0,142094202	-0,727306455
C2M6756	24.02.14	10:40	1500				t	n	3	12,50	15	57	20,3	19,85	68,5	78	1,15774839	1,783509857	-0,995463544
C2M6757	24.02.14	10:35	1500				c	n	2	4,75	15	26	18,8	19,78	63	77,5	-0,211950222	0,326607248	-0,482878589
C2M6758	24.02.14	13:46	1500	09.03.14	13:20	311,34	t	y	4	10,75	8	114	19,6	19,78	62,5	74	1,500159495	1,126607248	-0,833751056
C2M6759	24.02.14	13:48	1500	11.03.14	12:00	358,14	c	y	4	5,44	13	30	19	19,93	58,5	76	0,378953942	0,434255697	-0,731907888
C2M6760	24.02.14	13:40	1500				c	n	8	5,67	9	88	19,6	20,33	62,5	75,5	1,109255331	0,787984893	-1,675860525
C2M6761	24.02.14	13:44	1500	03.03.14	11:29	165,45	t	y	3	10,25	7	28	17,3	20,59	63,5	75	-1,060443281	-1,67209113	0,298769106
C2M6762	28.02.14	13:42	1500				t	n	2	1,00	10,5	40	18,1	20,13	61,5	79	-1,302854387	-0,588879705	-0,025195984
C2M6763	28.02.14	13:25	1500				t	n	0	1,00	1	2	19,8	20,73	60	74,5	1,569858107	0,741714088	2,015736542
C2M6764	28.02.14	10:02	1500				c	n	0	7,25	1	2	20,1	20,45	66,5	80	0,436542837	1,214103651	2,015736542
C2M6765	28.02.14	10:37	1500				c	n	6	5,25	12	103	19,1	20,63	63,5	75	0,739556719	0,103281789	-1,725722724
C2M6766	28.02.14	10:40	1500				c	n	2	5,50	5,5	40	18,2	20,26	64,5	78	-0,94225161	-0,568917717	0,622062833
C2M6767	28.02.14	10:35	1500				t	n	3	3,83	11	30	18,5	20,08	62,5	74	0,400159495	0,158095855	-0,236873710
C2M6768	28.02.14	13:46	1500				c	n	3	5,75	7	19	21,8	19,3	64,5	78	2,65774839	3,622132213	0,379030033
C2M6769	28.02.14	13:48	1500				t	n	4	5,50	10	21	18,8	19,96	60	75,5	0,309255331	0,215785386	-0,263291671
C2M6770	28.02.14	13:40	1500				t	n	6	6,00	10	44	20,4	20,53	59	75,5	1,909255331	1,46484949	-0,940664231
C2M6771	28.02.14	13:44	1500	01.03.14	14:24	24,4	c	y	5	4,10	9	36	17,2	20,22	60	74,5	-1,030141893	-1,544290636	-0,503738770
C2M6772	28.02.14	13:42	1500				t	n	5	5,67	8	42	18,6	20,06	62,5	73,5	0,630460883	-0,045782315	-0,427794291
C2M6773	28.02.14	13:25	1500				c	n	9	5,67	9	82	11,1	19,91	63,5	73,5	-6,869539117	-7,453430763	-1,858483892