

Fig. S1. Vanishing bearings (black circles) for Cornell birds individually released at Jersey Hill. The diagrams are explained in the Fig. 3 legend in the main text. (A) Birds with small magnets attached to their backs released under sunny skies ($N=130$, $r=0.183$, $\phi=170$ deg), and (B) birds with equivalent brass bars attached to them released under sunny skies between May 1973 and October 1979 ($N=124$, $r=0.198$, $\phi=178$ deg). These treatments apparently had no effect because both groups were similarly disoriented. (C) The results for 49 releases on 26 days under mostly sunny skies (six releases on overcast days) between August 1968 and October 1979 ($N=511$, $r=0.182$, $\phi=199$ deg). These are the results for Jersey Hill used in this study (supplementary material Table S1; see Data mining section in the main text).

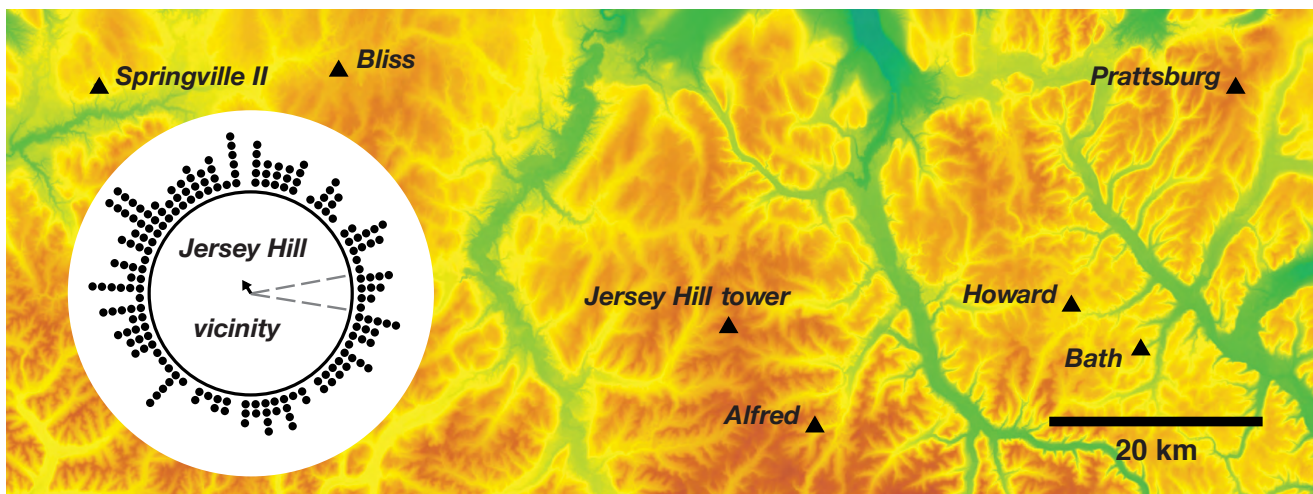


Fig. S2. Digital elevation model (DEM) of area around Jersey Hill (Fig. 1), showing six additional sites where Cornell birds were released on 17 days between September 1968 and September 1979 (supplementary material Table S1). These birds were also disoriented and the inset diagram at left shows the vanishing bearings (black circles) of these birds ($N=189$, $r=0.139$, $\phi=328$ deg). Dashed lines indicate the range of directions to loft, N is the number of birds and r is the mean vector length. The sites (bearings to loft, distance to loft, number of release days) are Alfred (80 deg, 118 km, 2), Bath (81 deg, 83 km, 2), Bliss (94 deg, 156 km, 2), Howard (85 deg, 89 km, 4), Prattsburg (99 deg, 74 km, 5) and Springville II (93 deg, 178 km, 2).

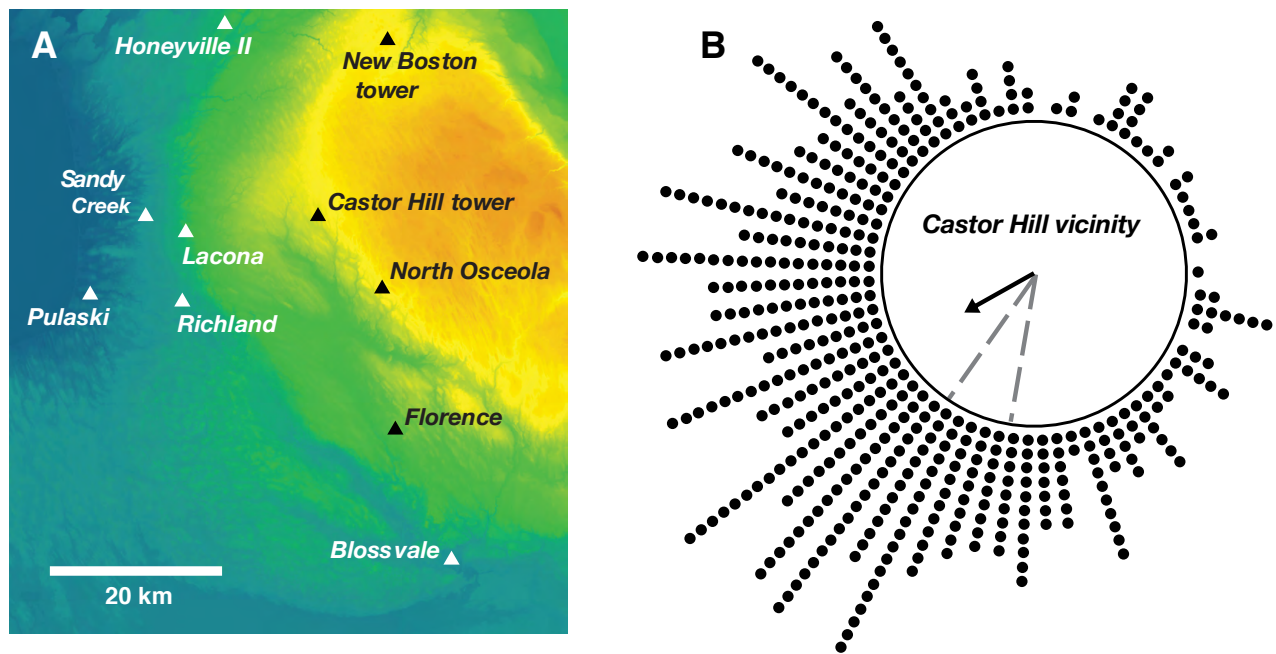


Fig. S3. (A) Digital elevation model (DEM) of area around Castor Hill (Fig. 1) showing nine additional sites where Cornell birds were released on 26 days between May 1975 and September 1979 (supplementary material Table S2). (B) Vanishing bearings (dots) of these birds also show significant clockwise deflections ($N=470$, $r=0.531$, $\phi=242$ deg). Dashed lines indicate the range of directions to loft, N is the number of birds and r is the mean vector length. The sites (bearings to loft, distance to loft, number of release days) are Blossvale (215 deg, 114 km, 2), Florence (208 deg, 124 km, 2), Honeyville II (193 deg, 162 km, 1), Lacona (194 deg, 137 km, 4), New Boston tower (200 deg, 166 km, 4), North Osceola (204 deg, 138 km, 2), Pulaski (189 deg, 127 km, 10), Richland (194 deg, 130 km, 4) and Sandy Creek (192 deg, 138 km, 14).

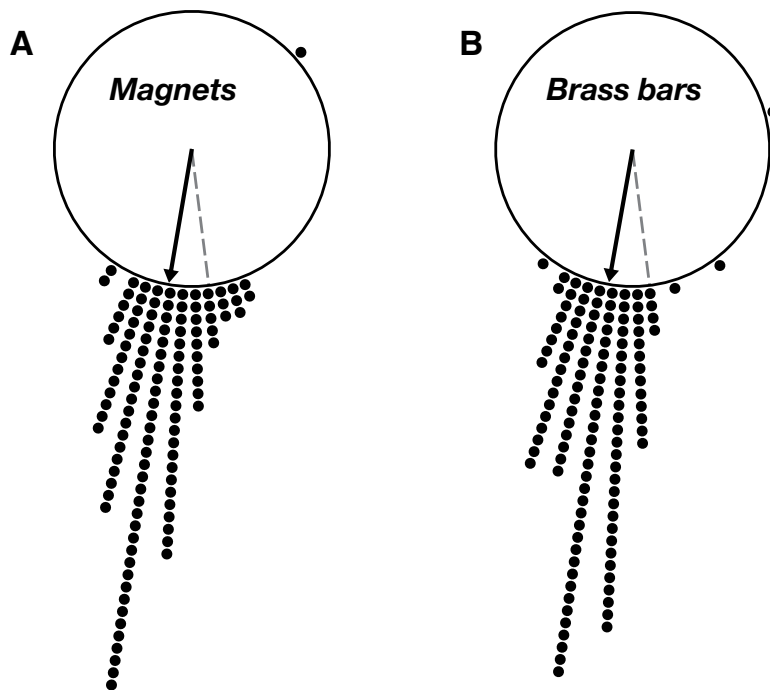


Fig. S4. Vanishing bearings (dots) for K birds (see Historical pigeon releases section in the main text) individually released between July and November 1974 under sunny skies at Weedsport. The diagrams are explained in the Fig. 3 legend in the main text. (A) Birds with small magnets attached to their backs ($N=124$, $r=0.971$, $\phi=188$ deg), and (B) birds with equivalent brass bars attached to them ($N=123$, $r=0.976$, $\phi=189$ deg). These treatments apparently had no effect because both groups were similarly well oriented.

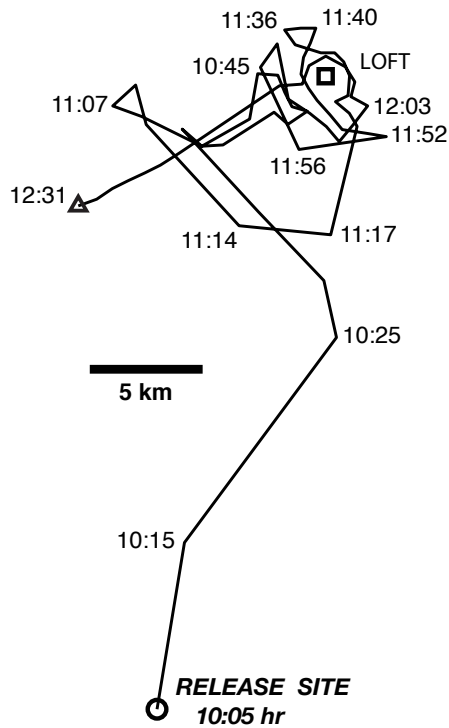


Fig. S5. Track of a pigeon with frosted lenses fitted over its eyes released on 25 August 1973, 16 km SSE of its loft in Lincoln, MA, under sunny skies. The bird was able to approach within ~1 km of the loft, but was not able to make its final approach due to impaired vision (after Schmidt-Koenig and Walcott, 1978).

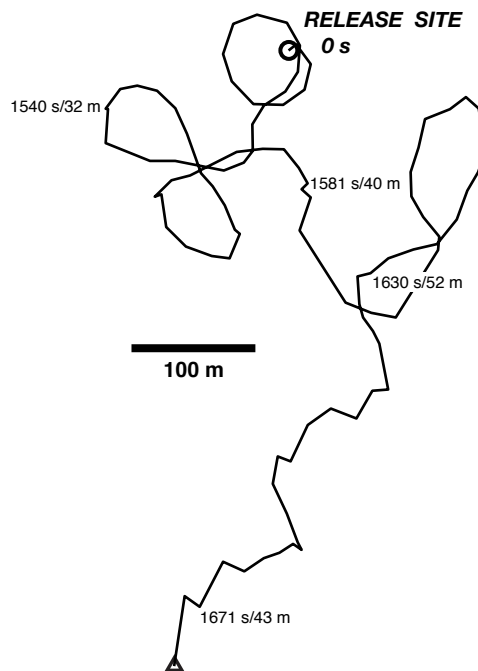


Fig. S6. Typical track (out of 150) recorded for a pigeon flying about the release site prior to departing in the homeward direction after approximately 1630 s. Elevations along the flight path are also given. Young and older birds were released as well as those that had been clock shifted. No discernible differences in flight paths were found between these groups of birds (after Elsner, 1978).

Table S1. JERSEY HILL TOWER AND VICINITY PIGEON RELEASE DATA

Direction (85°) and distance (120 km) to loft; latitude (42.3519°N) and (77.8845°W)
 longitude of site

RELEASE	DATE	N/N ₀	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
0088	08/02/68	23/23	239	0.439	YB	E	STR	NEW	SUN
0088	08/02/68	23/25	277	0.234	YB	W	STR	NEW	SUN
0107	08/28/68	12/12	267	0.250	YB	C	na	FAM	SUN
0107	08/28/68	12/12	246	0.494	YB	C	na	NEW	SUN
0124	09/24/68	22/23	170	0.303	YB	C	EXP	FAM	SUN
0244	07/24/69	11/12	167	0.501	na	C	EXP	NEW	O/C
0258	08/13/69	7/8	33	0.921	YRL	C	EXP	FAM	SUN
0383	08/05/70	11/13	118	0.188	OB	C	EXP	NEW	SUN
0778	06/08/72	11/13	262	0.316	YB	C	FF	NEW	SUN
0778	06/08/72	9/11	286	0.483	OB	C	EXP	NEW	SUN
0904	11/06/72	6/8	326	0.093	OB	C	EXP	na	SUN
0904	11/06/72	10/12	235	0.554	YB	C	EXP	NEW	SUN
0932	05/25/73	5/5	246	0.502	OB	B	EXP	na	SUN
0933	05/25/73	10/10	227	0.281	OB	C	EXP	na	O/C
1002	08/29/73	16/16	257	0.526	YB	F ₀	EXP	NEW	SUN
1043	10/23/73	11/12	301	0.320	YB	F ₀	EXP	FAM	SUN
1048	10/24/73	9/12	360	0.318	YB	F ₀	EXP	NEW	SUN
1892	10/21/77	11/12	260	0.349	YRL	B	EXP	NEW	SUN
1892	10/21/77	11/11	221	0.552	YRL	M	EXP	NEW	SUN
1893	10/21/77	4/4	186	0.798	OB	M	EXP	NEW	O/C
1893	10/21/77	4/5	97	0.207	OB	B	EXP	NEW	O/C
1896	10/22/77	12/13	237	0.574	YRL	B	EXP	NEW	SUN
1897	10/22/77	7/9	171	0.661	OB	B	EXP	NEW	O/C
1897	10/22/77	7/7	169	0.698	OB	M	EXP	NEW	O/C
1904	10/29/77	12/12	358	0.452	YRL	B	EXP	FAM	SUN
1904	10/29/77	12/14	47	0.394	YRL	M	EXP	FAM	SUN
1905	10/29/77	8/9	175	0.504	OB	M	EXP	FAM	SUN
1905	10/29/77	10/13	102	0.362	OB	B	EXP	FAM	SUN
1934	06/15/78	12/13	208	0.325	OB	CB	EXP	na	SUN
1934	06/15/78	12/14	93	0.370	OB	CM	EXP	na	SUN
1944	06/23/78	12/13	278	0.330	na	M	EXP	NEW	SUN
1944	06/23/78	12/13	166	0.606	na	B	EXP	NEW	SUN
2014	08/02/78	12/13	232	0.487	na	M	EXP	FAM	SUN
2051	08/21/78	10/11	164	0.313	na	B	EXP	FAM	SUN
2051	08/21/78	12/13	157	0.374	na	M	EXP	FAM	SUN
2075	09/02/78	9/12	229	0.161	na	M	EXP	FAM	SUN
2075	09/02/78	10/11	133	0.525	na	B	EXP	FAM	SUN
2132	10/29/78	4/4	345	0.919	na	M	EXP	FAM	S/O
2132	10/29/78	4/4	176	0.574	na	B	EXP	FAM	S/O

Table S1. continued

RELEASE	DATE	N/N_0	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
2134	10/31/78	11/12	282	0.484	<i>na</i>	B	EXP	FAM	SUN
2134	10/31/78	10/11	176	0.428	<i>na</i>	M	EXP	FAM	SUN
2197	07/07/79	10/11	107	0.464	OB	CM	EXP	FAM	SUN
2197	07/07/79	9/14	135	0.271	OB	CB	EXP	FAM	SUN
2274	09/10/79	10/11	116	0.369	<i>na</i>	CM	EXP	FAM	SUN
2274	09/10/79	10/12	137	0.554	<i>na</i>	CB	EXP	FAM	SUN
2296	10/17/79	10/11	145	0.417	OB	B	EXP	FAM	O/C
2296	10/17/79	10/12	171	0.908	OB	M	EXP	FAM	O/C

ALFRED

Direction (80°) and distance (118 km) to loft; latitude (42.2649°N) and (77.7900°W) longitude of site

2198	07/07/79	12/13	300	0.683	YRL	C	EXP	NEW	SUN
2275	09/10/79	12/12	326	0.504	<i>na</i>	C	EXP	NEW	SUN
2275	09/10/79	12/12	61	0.793	OB	C	EXP	NEW	SUN

BATH

Direction (81°) and distance (83 km) to loft; latitude (42.3321°N) and (77.4265°W) longitude of site

0200	05/22/69	8/9	350	0.887	OB	C	EXP	<i>na</i>	S/O
0200	05/22/69	5/5	274	0.591	OB	C	EXP	<i>na</i>	S/O
0204	05/27/69	15/18	324	0.400	OB	C	EXP	<i>na</i>	SUN

BLISS

Direction (94°) and distance (156 km) to loft; latitude (42.5482°N) and (78.3254°W) longitude of site

0276	09/09/69	12/12	271	0.401	YB	C	EXP	NEW	SUN
0299	10/15/69	9/11	221	0.320	YB	C	EXP	<i>na</i>	SUN

HOWARD

Direction (85°) and distance (89 km) to loft; latitude (42.3643°N) and (77.5060°W) longitude of site

0335	06/08/70	17/20	36	0.299	OB	C	EXP	<i>na</i>	SUN
0337	06/09/70	9/14	1	0.591	YRL	C	EXP	<i>na</i>	SUN
0906	11/07/72	7/13	347	0.366	YRL	C	EXP	NEW	SUN
0907	11/10/72	9/11	246	0.631	OB	C	EXP	<i>na</i>	O/C

Table S1. Continued

RELEASE	DATE	N/N_0	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
PRATTSBURG									
Direction (99°) and distance (74 km) to loft; latitude (42.5448°N) and (77.3232°W) longitude of site									
0126	09/26/68	9/14	51	0.321	YB	C	EXP	<i>na</i>	S/O
0146	10/08/68	4/8	260	0.087	YB	C	EXP	FAM	O/C
0150	10/12/68	4/5	119	0.623	YRL	C	EXP	NEW	S/O
0150	10/12/68	8/11	286	0.437	YRL	C	EXP	FAM	S/O
0154	10/15/68	6/9	118	0.512	YRL	C	EXP	<i>na</i>	SUN
0252	08/06/69	6/8	322	0.247	OB	C	EXP	<i>na</i>	SUN
0468	10/29/70	7/12	161	0.352	OB	C	EXP	<i>na</i>	O/C
SPRINGVILLE II									
Direction (93°) and distance (178 km) to loft; latitude (42.5305°N) and (78.5933°W) longitude of site									
0275	09/09/69	9/12	207	0.600	YB	C	EXP	NEW	SUN
0298	10/15/69	9/10	145	0.492	YB	C	EXP	<i>na</i>	SUN

Notes: All data are from the Keeton database collected between 1967 and 1980 by W.T. Keeton and his students at Cornell University. N is the number of vanishing bearings recorded and N_0 is the number of birds released; MEAN is the mean vanishing bearing, in degrees, for the release; r is the mean vector length; AGE of birds: YB is young birds, YRL is yearlings, OB is old birds; TREAT is treatment: C is controls, B is birds with brass bars, M is birds with magnets, CB is controls for brass bar treatment, CM is controls for magnet treatment, F_0 are “no bias” birds at Castor Hill, and E (W) are birds trained to the east (west) of the loft; TRAIN is homing training of birds: EXP is experienced, and STR is some training; SITE EXP is experience of birds at site: NEW is new to site, and FAM is familiar with site; SKY is weather conditions: SUN is sunny, O/C is overcast, and S/O is overcast with the sun occasionally breaking through; and *na* is not available.

Table S2. CASTOR HILL TOWER AND VICINITY PIGEON RELEASE DATA

Direction (200°) and distance (143 km) to loft; latitude (42.6492°N) and (75.8422°W)
 longitude of site

RELEASE	DATE	N/N_0	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
0162	10/22/68	12/14	254	0.697	YRL	C	EXP	NEW	SUN
0163	10/22/68	14/14	289	0.933	YRL	C	EXP	NEW	SUN
0165	10/28/68	14/16	278	0.715	<i>na</i>	C	<i>na</i>	<i>na</i>	SUN
0220	06/11/69	14/15	262	0.733	YRL	C	EXP	NEW	SUN
0248	07/31/69	6/8	278	0.964	OB	C	EXP	NEW	SUN
0248	07/31/69	7/8	270	0.923	OB	C	EXP	FAM	SUN
0255	08/12/69	10/12	257	0.827	OB	C	EXP	FAM	SUN
0374	07/22/70	11/12	33	0.068	OB	C	EXP	<i>na</i>	SUN
0466	10/27/70	13/13	253	0.739	YRL	C	EXP	NEW	O/C
0466	10/27/70	12/13	241	0.925	<i>na</i>	C	EXP	FAM	O/C
0475	11/02/70	5/6	249	0.816	OB	C	EXP	FAM	SUN
0704	10/20/71	11/16	274	0.881	<i>na</i>	C	EXP	<i>na</i>	SUN
0705	10/20/71	10/12	286	0.846	YB	C	FF	NEW	SUN
0747	05/10/72	11/13	239	0.828	YRL	C	EXP	FAM	SUN
0747	05/10/72	12/13	253	0.758	YRL	C	EXP	NEW	SUN
0782	06/14/72	10/12	301	0.551	OB	C	EXP	NEW	O/C
0848	08/11/72	7/8	272	0.891	OB	C	EXP	<i>na</i>	SUN
0848	08/11/72	11/18	281	0.964	YRL	C	EXP	<i>na</i>	SUN
0875	09/20/72	12/13	249	0.906	YRL	C	EXP	FAM	SUN
0889	10/05/72	8/12	253	0.933	YRL	C	EXP	FAM	SUN
0890	10/05/72	5/9	242	0.961	YB	C	EXP	FAM	SUN
1221	08/13/74	9/15	269	0.857	YRL	C	EXP	NEW	SUN
1226	08/14/74	6/11	248	0.819	YRL	F_0	EXP	FAM	SUN
1226	08/14/74	11/12	282	0.840	YB	C	FF	NEW	SUN
1226	08/14/74	12/12	244	0.814	YRL	F_0	EXP	NEW	SUN
1230	08/14/74	4/5	270	0.612	YRL	C	EXP	<i>na</i>	SUN
1319	10/11/74	11/15	251	0.487	YB	C	EXP	NEW	SUN
1385	06/02/75	7/9	220	0.898	OB	C	EXP	FAM	SUN
1385	06/02/75	6/7	161	0.700	OB	C	EXP	NEW	SUN
1394	06/10/75	10/13	235	0.899	OB	C	EXP	FAM	SUN
1394	06/10/75	10/13	257	0.862	YRL	C	EXP	NEW	SUN
1394	06/10/75	7/9	214	0.933	OB	F_0	EXP	FAM	SUN
1412	07/01/75	12/13	273	0.785	YRL	C	EXP	NEW	SUN
1413	07/01/75	11/11	235	0.894	YRL	C	EXP	NEW	SUN
1413	07/01/75	11/11	210	0.691	OB	F_0	EXP	FAM	SUN
1434	07/23/75	10/11	234	0.506	YRL	C	EXP	<i>na</i>	SUN
1434	07/23/75	12/13	210	0.883	OB	F_0	EXP	FAM	SUN
1441	07/30/75	8/8	206	0.968	OB	F_0	EXP	FAM	SUN
1441	07/30/75	8/8	282	0.599	OB	C	EXP	FAM	SUN

Table S2. continued

RELEASE	DATE	N/N ₀	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
1441	07/30/75	7/8	210	0.832	OB	F ₀	EXP	FAM	SUN
1442	07/30/75	7/7	228	0.867	OB	F ₀	EXP	FAM	SUN
1442	07/30/75	4/4	222	0.920	OB	F ₀	EXP	FAM	SUN
1462	08/15/75	12/14	299	0.590	OB	C	EXP	FAM	SUN
1468	08/19/75	10/11	211	0.923	OB	F ₀	EXP	FAM	SUN
1468	08/19/75	11/13	252	0.880	OB	C	EXP	FAM	SUN
1481	08/28/75	12/13	236	0.859	OB	C	EXP	FAM	SUN
1527	10/27/75	12/13	214	0.873	OB	F ₀	EXP	FAM	SUN
1527	10/27/75	9/12	240	0.963	YB	C	EXP	NEW	SUN
1527	10/27/75	11/13	224	0.913	OB	F ₀	EXP	FAM	SUN
1536	11/05/75	5/5	238	0.821	YRL	C	EXP	FAM	SUN
1536	11/05/75	7/7	235	0.930	YRL	C	EXP	FAM	SUN
1536	11/05/75	10/11	221	0.947	YRL	C	EXP	FAM	SUN
1563	05/28/76	15/20	211	0.945	OB	F ₀	EXP	FAM	SUN
1563	05/28/76	8/9	252	0.730	YRL	C	EXP	NEW	SUN
1563	05/28/76	11/12	242	0.819	OB	C	EXP	FAM	SUN
1579	06/18/76	15/16	228	0.882	OB	C	EXP	FAM	SUN
1579	06/18/76	11/12	273	0.960	YRL	C	EXP	NEW	SUN
1681	09/29/76	10/10	278	0.868	YRL	C	EXP	NEW	SUN
1682	09/29/76	9/9	229	0.862	OB	F ₀	EXP	FAM	SUN
1682	09/29/76	10/10	236	0.897	OB	F ₀	EXP	FAM	SUN
1867	08/26/77	11/11	260	0.762	OB	C	EXP	FAM	SUN
1867	08/26/77	12/12	300	0.778	YB	C	EXP	NEW	SUN
1881	09/29/77	9/9	225	0.944	OB	F ₀	EXP	FAM	SUN
1882	09/29/77	11/11	272	0.629	na	C	EXP	NEW	SUN
2004	07/25/78	10/12	240	0.905	OB	F ₀	EXP	FAM	SUN
2004	07/25/78	10/12	303	0.913	YRL	C	EXP	NEW	SUN
2038	08/14/78	7/8	226	0.967	OB	F ₀	EXP	FAM	SUN
2038	08/14/78	10/11	283	0.851	YRL	C	EXP	FAM	SUN
2268	09/08/79	11/11	222	0.968	OB	F ₀	EXP	FAM	SUN
2277	09/12/79	10/11	285	0.893	OB	C	EXP	NEW	SUN
2277	09/12/79	9/9	228	0.967	OB	F ₀	EXP	FAM	SUN
2292	09/27/79	12/13	294	0.858	YB	C	EXP	NEW	SUN
2496	08/25/80	12/14	277	0.597	YB	C	EXP	NEW	SUN
2525	09/29/80	10/13	262	0.872	YB	C	EXP	NEW	SUN
2526	09/29/80	11/13	265	0.928	OB	C	EXP	FAM	SUN

BLOSSVALE

Direction (215°) and distance (114 km) to loft; latitude (43.2809°N) and (75.6484°W) longitude of site

Table S2. Continued

RELEASE	DATE	N/N_0	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
1516	10/15/75	5/13	239	0.801	OB	C	EXP	NEW	SUN
1516	10/15/75	8/12	216	0.878	YRL	C	EXP	NEW	SUN
1573	06/10/76	11/13	275	0.727	YRL	C	EXP	NEW	SUN
1573	06/10/76	6/11	280	0.718	OB	C	EXP	NEW	SUN

FLORENCE

Direction (208°) and distance (124 km) to loft; latitude (43.4203°N) and (75.7294°W)
longitude of site

1405	06/23/75	4/8	247	0.879	OB	C	EXP	NEW	SUN
1405	06/23/75	10/13	296	0.814	YRL	C	EXP	NEW	SUN
1506	10/03/75	11/13	260	0.880	OB	C	EXP	NEW	SUN
1506	10/03/75	8/14	258	0.937	YRL	C	EXP	NEW	SUN

HONEYVILLE II

Direction (193°) and distance (162 km) to loft; latitude (43.8557°N) and (75.9784°W)
longitude of site

2278	09/12/79	8/11	246	0.880	YRL	C	EXP	NEW	SUN
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LACONA

Direction (194°) and distance (137 km) to loft; latitude (43.6332°N) and (75.0384°W)
longitude of site

1370	05/08/75	12/12	262	0.920	YRL	C	EXP	NEW	SUN
1559	05/13/76	12/12	314	0.638	YB	C	FF	NEW	SUN
1559	05/13/76	12/12	272	0.593	YRL	C	EXP	NEW	SUN
2269	09/08/79	9/12	275	0.618	YRL	C	EXP	NEW	SUN

NEW BOSTON TOWER

Direction (200°) and distance (166 km) to loft; latitude (43.8353°N) and (75.7354°W)
longitude of site

1529	10/28/75	8/12	228	0.503	YB	C	EXP	NEW	SUN
1529	10/28/75	11/12	231	0.659	OB	C	EXP	NEW	SUN
1565	06/03/76	11/11	215	0.507	OB	C	EXP	NEW	SUN
1565	06/03/76	11/12	317	0.642	YRL	C	EXP	NEW	SUN

NORTH OSCEOLA

Direction (204°) and distance (138 km) to loft; latitude (43.5716°N) and (75.7475°W)
longitude of site

Table S2. Continued

RELEASE	DATE	N/N ₀	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
1398	06/11/75	11/13	277	0.791	YRL	C	EXP	NEW	SUN
1404	06/23/75	9/9	255	0.987	OB	C	EXP	NEW	SUN
1404	06/23/75	6/9	269	0.975	YRL	C	EXP	NEW	SUN

PULASKI

Direction (189°) and distance (127 km) to loft; latitude (43.5657°N) and (76.1801°W)
longitude of site

1415	07/01/75	11/13	162	0.710	YRL	C	EXP	NEW	SUN
1459	08/14/75	9/14	201	0.954	OB	C	EXP	NEW	SUN
1459	08/14/75	10/13	188	0.505	YRL	C	EXP	NEW	SUN
1487	09/05/75	11/13	195	0.447	YRL	C	EXP	NEW	SUN
1487	09/05/75	9/12	192	0.645	OB	C	EXP	NEW	SUN
1501	09/30/75	11/11	198	0.817	OB	C	EXP	NEW	SUN
1526	10/24/75	12/12	205	0.471	YB	C	FF	NEW	SUN
1526	10/24/75	13/13	221	0.620	OB	C	EXP	NEW	SUN
1535	11/05/75	6/6	175	0.819	YB	C	EXP	NEW	SUN
1535	11/05/75	6/7	176	0.741	YB	C	FF	NEW	SUN
1646	08/20/76	8/8	282	0.135	YRL	C	FF	NEW	SUN
1646	08/20/76	11/12	183	0.406	YRL	C	EXP	NEW	SUN

RICHLAND

Direction (194°) and distance (130 km) to loft; latitude (43.5585°N) and (76.0434°W)
longitude of site

1460	08/14/75	12/12	283	0.662	YRL	C	EXP	NEW	SUN
1486	09/05/75	10/13	226	0.775	OB	C	EXP	NEW	SUN
1486	09/05/75	11/14	239	0.741	YRL	C	EXP	NEW	SUN
1502	09/30/75	12/14	259	0.876	YRL	C	EXP	NEW	SUN
1645	08/20/76	10/10	277	0.930	YB	C	FF	NEW	SUN
1645	08/20/76	11/12	256	0.751	YRL	C	EXP	NEW	SUN

SANDY CREEK

Direction (192°) and distance (138 km) to loft; latitude (43.6500°N) and (76.0981°W)
longitude of site

1369	05/08/75	6/11	283	0.473	YRL	C	EXP	NEW	SUN
1373	05/20/75	7/9	280	0.526	OB	C	EXP	NEW	SUN
1374	05/20/75	6/9	96	0.212	YRL	C	EXP	FAM	SUN
1376	05/22/75	10/11	235	0.552	OB	C	EXP	NEW	SUN
1377	05/23/75	10/12	303	0.587	YB	C	FF	NEW	SUN

Table S2. Continued

RELEASE	DATE	N/N_0	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
1377	05/23/75	6/9	196	0.879	OB	C	EXP	FAM	SUN
1395	06/10/75	5/5	183	0.946	YRL	C	EXP	NEW	SUN
1414	07/01/75	10/13	236	0.588	YRL	C	EXP	NEW	SUN
1463	08/15/75	5/9	249	0.807	OB	C	EXP	NEW	SUN
1470	08/19/75	9/11	219	0.870	OB	C	EXP	NEW	SUN
1525	10/24/75	3/3	238	0.938	OB	C	EXP	NEW	SUN
1525	10/24/75	5/8	213	0.528	OB	C	EXP	FAM	SUN
1525	10/24/75	10/11	333	0.689	YB	C	FF	NEW	SUN
2270	09/08/79	12/13	223	0.604	OB	C	EXP	NEW	SUN

Notes: All data are from the Keeton database collected between 1967 and 1980 by W.T. Keeton and his students at Cornell University. N is the number of vanishing bearings recorded and N_0 is the number of birds released; MEAN is the mean vanishing bearing, in degrees, for the release; r is the mean vector length; AGE of birds: YB is young birds, YRL is yearlings, OB is old birds; TREAT is treatment: C is controls, and F_0 are “no bias” birds; TRAIN is homing training of birds: EXP is experienced; SITE EXP is experience of birds at site: NEW is new to site, FF is first flight, and FAM is familiar with site; SKY is weather conditions: SUN is sunny, and O/C is overcast; and *na* is not available.

Table S3. WEEDSPORT PIGEON RELEASE DATA

Direction (173°) and distance (74 km) to loft; latitude (43.0965°N) and (76.5469°W)
 longitude of site

RELEASE	DATE	N/N ₀	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
0756	05/23/72	8/12	174	0.972	YRL	K	EXP	FAM	SUN
0796	07/06/72	19/24	192	0.957	YRL	K	EXP	FAM	SUN
0812	07/10/72	20/27	181	0.952	YRL	K	EXP	FAM	SUN
0840	07/31/72	11/13	186	0.953	YRL	K	EXP	FAM	SUN
0854	08/21/72	7/11	196	0.964	YRL	K	EXP	FAM	SUN
0857	08/25/72	7/14	202	0.971	YRL	K	EXP	FAM	SUN
0876	09/21/72	7/13	195	0.995	YRL	K	EXP	FAM	SUN
0882	10/03/72	8/8	186	0.986	YRL	K	EXP	FAM	SUN
0892	10/10/72	8/9	192	0.968	YRL	K	EXP	FAM	SUN
0901	10/26/72	6/12	194	0.978	YRL	K	EXP	FAM	SUN
0911	04/17/73	7/13	185	0.988	OB	K	EXP	FAM	SUN
0913	04/18/73	11/12	180	0.955	OB	K	EXP	FAM	SUN
0915	04/19/73	11/12	178	0.959	YRL	K	EXP	FAM	SUN
0917	04/20/73	8/11	186	0.992	OB	K	EXP	FAM	SUN
0918	04/20/73	9/12	174	0.975	OB	K	EXP	FAM	SUN
0922	04/30/73	9/12	189	0.987	OB	K	EXP	FAM	SUN
0941	06/06/73	7/8	181	0.951	OB	K	EXP	FAM	SUN
0948	06/14/73	10/13	192	0.963	OB	K	EXP	FAM	SUN
0960	07/02/73	21/25	189	0.950	OB	K	EXP	FAM	SUN
0962	07/05/73	12/12	192	0.982	OB	K	EXP	FAM	SUN
0965	07/09/73	9/12	196	0.958	OB	K	EXP	FAM	SUN
0968	07/11/73	14/14	192	0.989	OB	K	EXP	FAM	SUN
0980	07/26/73	23/25	190	0.968	OB	K	EXP	FAM	SUN
0983	07/31/73	21/25	192	0.972	OB	K	EXP	FAM	SUN
0990	08/08/73	20/25	188	0.974	OB	K	EXP	FAM	SUN
0993	08/13/73	9/11	188	0.966	OB	K	EXP	FAM	SUN
1013	09/07/73	10/10	189	0.984	OB	K	EXP	FAM	SUN
1074	05/02/74	8/13	189	0.995	OB	K	EXP	FAM	SUN
1081	05/08/74	9/13	183	0.962	OB	K	EXP	FAM	SUN
1084	05/14/74	9/13	182	0.986	OB	K	EXP	FAM	SUN
1086	05/16/74	9/13	185	0.974	OB	K	EXP	FAM	SUN
1088	05/20/74	9/13	183	0.986	OB	K	EXP	FAM	SUN
1091	05/21/74	7/13	188	0.987	OB	K	EXP	FAM	SUN
1094	05/22/74	8/13	184	0.985	OB	K	EXP	FAM	SUN
1102	06/04/74	9/12	189	0.974	YRL	K	EXP	FAM	SUN
1106	06/05/74	7/12	175	0.944	YRL	K	EXP	FAM	SUN
1110	06/06/74	10/11	127	0.952	YRL	K	EXP	FAM	SUN
1113	06/07/74	6/10	179	0.957	YRL	K	EXP	FAM	SUN
1151	07/10/74	8/12	191	0.976	YRL	K	EXP	FAM	SUN

Table S3. continued

RELEASE	DATE	N/N_0	MEAN	r	AGE	TREAT	TRAIN	SITE EXP	SKY
1168	07/17/74	9/12	199	0.956	YRL	K	EXP	FAM	SUN
1201	08/02/74	10/12	177	0.961	YRL	K	EXP	FAM	SUN
1206	08/06/74	8/12	191	0.982	YRL	K	EXP	FAM	SUN
1215	08/09/74	11/12	177	0.954	YRL	K	EXP	FAM	SUN
1235	08/16/74	6/13	202	0.965	YRL	K	EXP	FAM	SUN
1252	08/23/74	9/12	192	0.957	YRL	K	EXP	FAM	SUN
1286	09/13/74	7/8	187	0.968	YRL	K	EXP	FAM	SUN
1289	09/16/74	15/17	187	0.974	YRL	K	EXP	FAM	SUN
1381	05/29/75	13/14	187	0.991	OB	K	EXP	FAM	SUN
1386	06/03/75	11/16	192	0.986	OB	K	EXP	FAM	SUN
1388	06/04/75	12/15	187	0.991	OB	K	EXP	FAM	SUN
1393	06/09/75	13/15	191	0.988	OB	K	EXP	FAM	SUN
1396	06/10/75	12/14	180	0.968	OB	K	EXP	FAM	SUN

Notes: All data are from the Keeton database collected between 1967 and 1980 by W.T. Keeton and his co-workers at Cornell University. N is the number of vanishing bearings recorded and N_0 is the number of birds released; MEAN is the mean vanishing bearing, in degrees, for the release; r is the mean vector length; AGE of birds: YRL is yearlings, OB is old birds; TREAT is treatment: K indicates similarly aged, experienced birds that were only released at Weedsport; TRAIN is homing training of birds: EXP is experienced; SITE EXP is experience of birds at site: FAM is familiar with site; SKY is weather conditions: SUN is sunny.

Table S4. CORNELL LOFT TO WEEDSPORT HARPA RUNS

RELEASE	DATE	353°	320°	7°	40°	307°	Vanish
0756	05/23/72	9	10	8	7	9	174
0796	07/02/72	3	0	5	7	0	192
0812	07/10/72	8	9	5	0	9	181
0840	07/31/72	5	4	5	7	3	186
0854	08/21/72	9	19	8	5	12	196
0857	08/25/72	0	4	0	0	7	202
0876	09/21/72	5	5	4	0	7	195
0882	10/03/72	5	8	4	2	8	186
0892	10/10/72	16	19	14	8	19	192
0901	10/26/72	10	11	9	3	10	194
0911	04/17/73	0	9	0	0	10	185
0913	04/18/73	5	8	3	0	9	180
0915	04/19/73	3	4	3	3	4	178
0917	04/20/73	7	7	5	5	7	186
0922	04/30/73	4	11	4	3	11	189
0941	06/06/73	0	4	0	0	7	181
0948	06/14/73	10	9	9	8	9	192
0960	07/02/73	5	8	4	2	9	189
0962	07/05/73	7	7	5	4	8	192
0965	07/09/73	5	7	4	1	8	196
0968	07/11/73	4	4	3	1	3	192
0980	07/26/73	8	10	7	4	10	190
0983	07/31/73	5	7	5	4	8	192
0990	08/08/73	7	10	4	0	10	188
0993	08/13/73	3	8	1	0	10	188
1013	09/07/73	10	20	0	0	21	189
1074	05/02/74	14	18	13	3	18	189
1081	05/08/74	8	8	7	4	8	183
1084	05/14/74	3	13	0	0	15	182
1086	05/16/74	10	16	5	0	18	185
1088	05/20/74	9	12	7	5	13	183
1091	05/21/74	11	13	9	0	13	188
1094	05/22/74	7	12	5	2	12	184
1102	06/04/74	4	7	3	2	8	189
1106	06/05/74	5	7	5	4	7	175
1110	06/06/74	0	0	0	7	2	127
1113	06/07/74	12	13	13	10	13	179
1151	07/10/74	8	10	8	3	10	191
1168	07/17/74	2	12	13	11	11	199
1201	08/02/74	4	5	4	2	5	177
1206	08/06/74	7	5	7	5	5	191

Table S4. continued

RELEASE	DATE	353°	320°	7°	40°	307°	Vanish
1215	08/09/74	1	1	1	2	1	177
1235	08/16/74	5	8	5	4	8	202
1252	08/23/74	10	11	9	3	11	192
1286	09/13/74	1	8	0	0	9	187
1289	09/16/74	3	2	0	0	15	187
1381	05/29/75	8	10	8	7	9	187
1386	06/03/75	3	5	2	1	7	192
1388	06/04/75	18	22	14	0	20	187
1393	06/09/75	13	11	13	10	10	191
1396	06/10/75	3	2	4	10	1	180

Notes: All release data are from the Keeton database collected between 1967 and 1980 by W.T. Keeton and his students at Cornell University. RELEASE is the release number in the Keeton database, and DATE is the date of the release. Launch azimuth values are the percentage of rays (from HARPA plots with constant 10 km vertical axes) within the ephemeral ducts (number of rays/91) along azimuths, 353° directly to the release site, 320° up the Lake Cayuga valley, 7° across to Weedsport from Lake Cayuga, 40° up the Fall Creek valley, and 307° across to Weedsport from the top of the Tully Valley (Fig. 9). Vanish is the mean vanishing bearing for each release (Table S3).