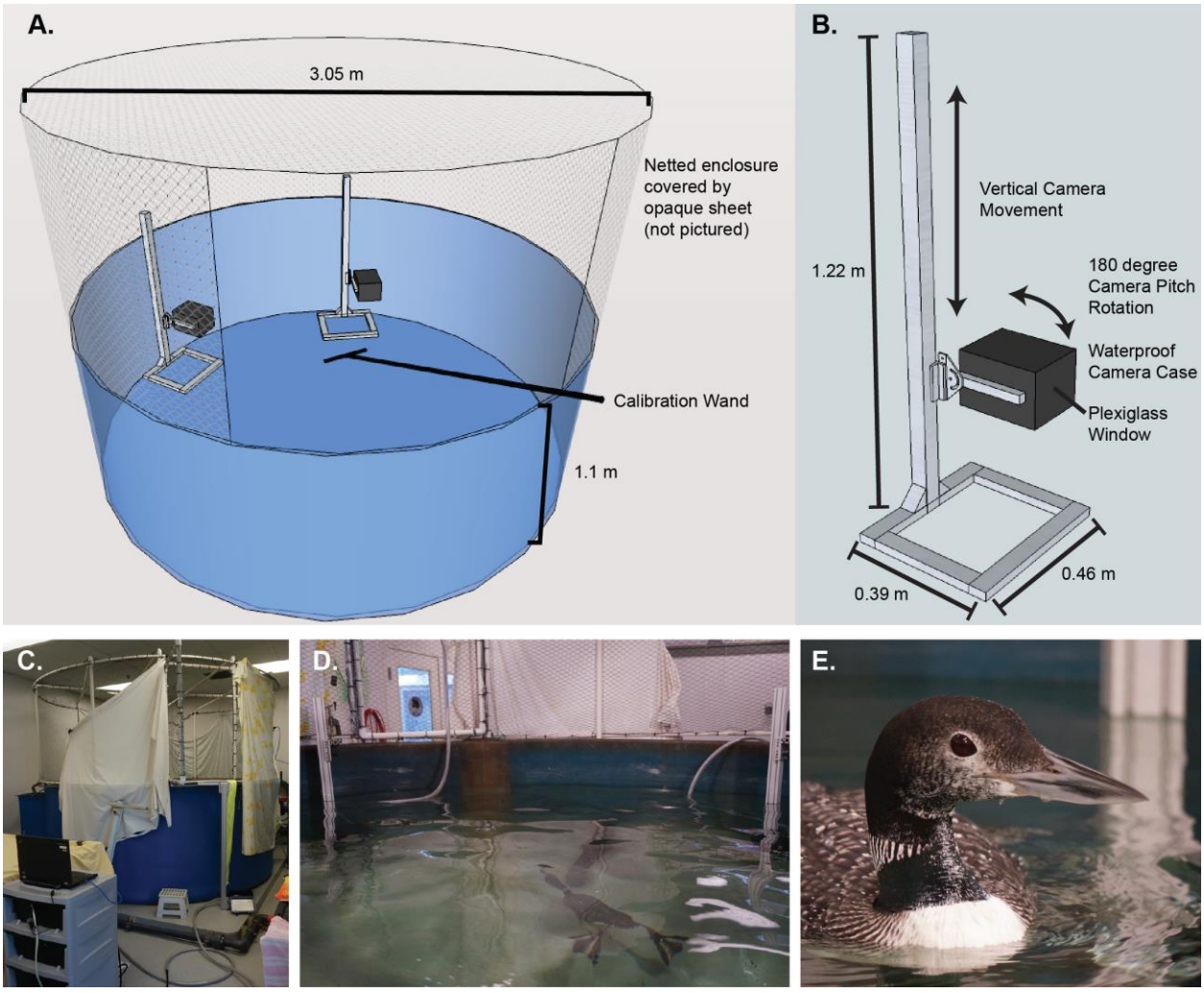


Figure S1. **Filming set-up at the Tufts Wildlife Clinic.** (A) Two cameras were placed in a 3.3 m diameter pool, where rehabilitating loons were housed. A calibration wand was used to calibrate the area for 3D reconstruction. (B) Custom camera cases and stands were built for IDT NR5S1 cameras. Scuba dive boxes were outfitted with a Plexiglass window, removable camera mount, and plumbing tube (to waterproof and protect the camera's cable to its power box). The stand was built using 80/20 aluminum framing. (C) While recording, a sheet was placed over the netting to reduce loons stress levels. (D) Loons voluntarily swam underwater in the field of view of both cameras. (E) All four common loons were healthy and released to the wild within 24 hours of recording.

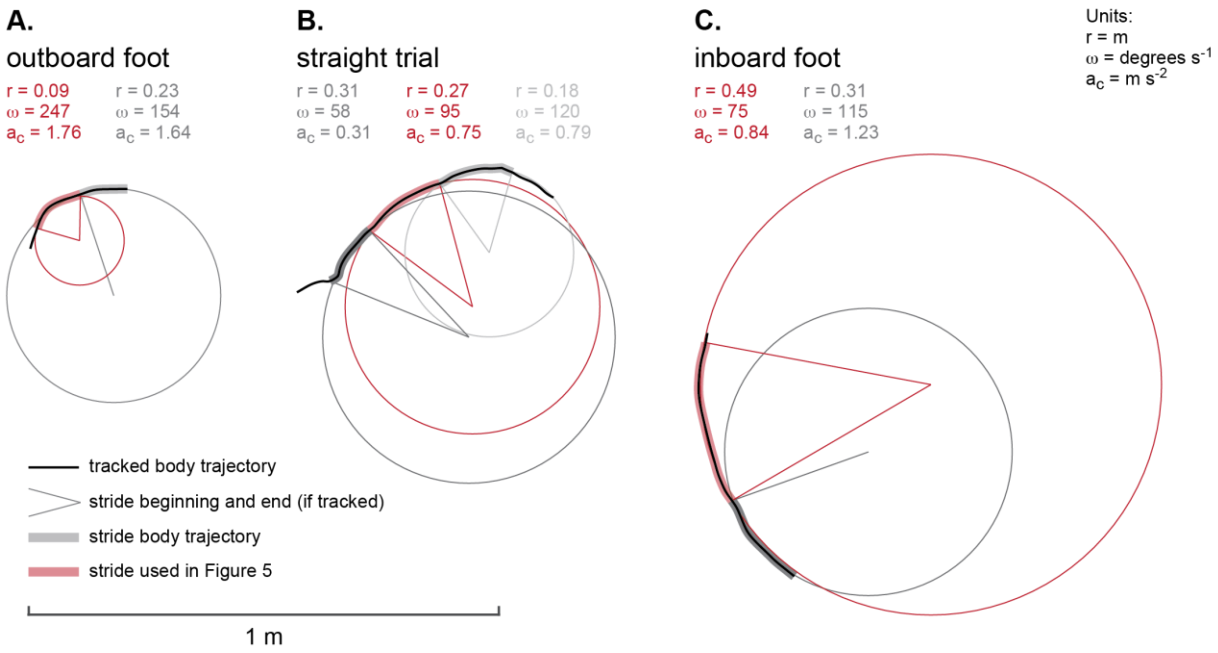


Figure S2. **Analysis of turns using body trajectory data from strides shown in Figure 5.** Maneuverability and agility were determined by analyzing the trajectory of the loon's body during individual strides. For each stride where over 70% of the stride was tracked, a circle was fit to the horizontal traces of the body. The radius of the curvature (r), angular velocity (ω), and centripetal acceleration (a_c) were calculated for each stride. The panels in this figure represent the strides displayed in Fig. 5 (red) for (A) a turn with the outboard foot tracked, (B) straight swimming, and (C) a turn with the inboard foot tracked. All panels are scaled to the 1 m scale bar.

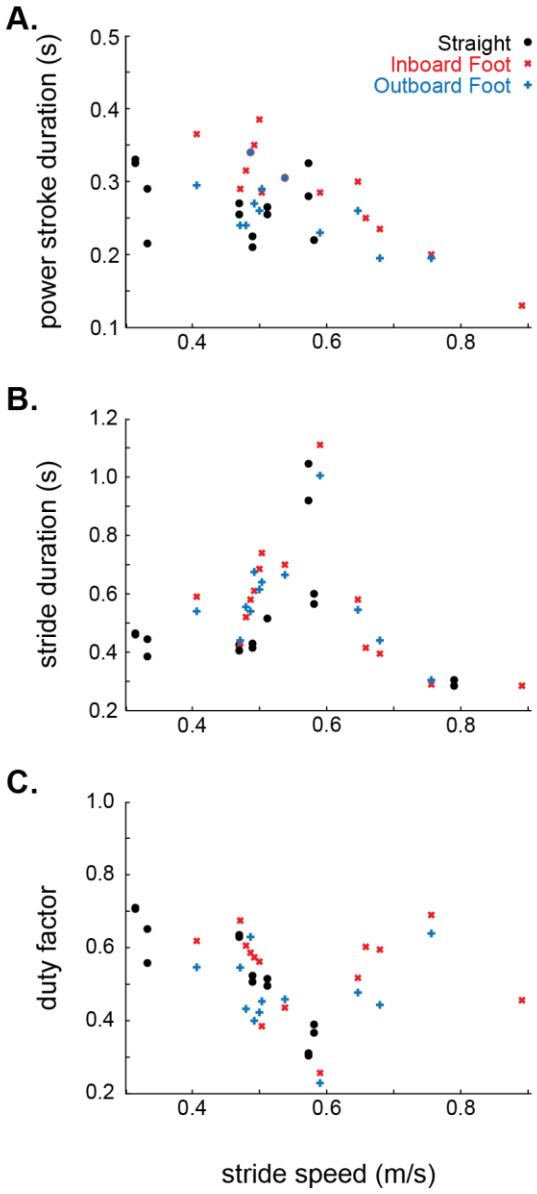


Figure S3. Kinematic parameters for straight swimming and turning strides versus swimming speed. The timing of paddling was calculated for over 100 strides from 19 trials. Body speed was tracked during 23 full strides, corresponding to 46 potential foot paddles. Based on the visibility in the video recordings for each foot paddle, the following kinematic parameters were calculated: (A) power stroke duration, (B) stride duration, and (C) duty factor, or the fraction of the full stride used for the power stroke. Linear mixed effects models were fit to the data incorporating errors from individual variation as well as the impact of speed and foot type category. Statistical analyses were repeated comparing straight (black circles) versus inboard foot (red "x") versus outboard foot (blue "+") data and while binning together inboard and outboard strides as all turning data.

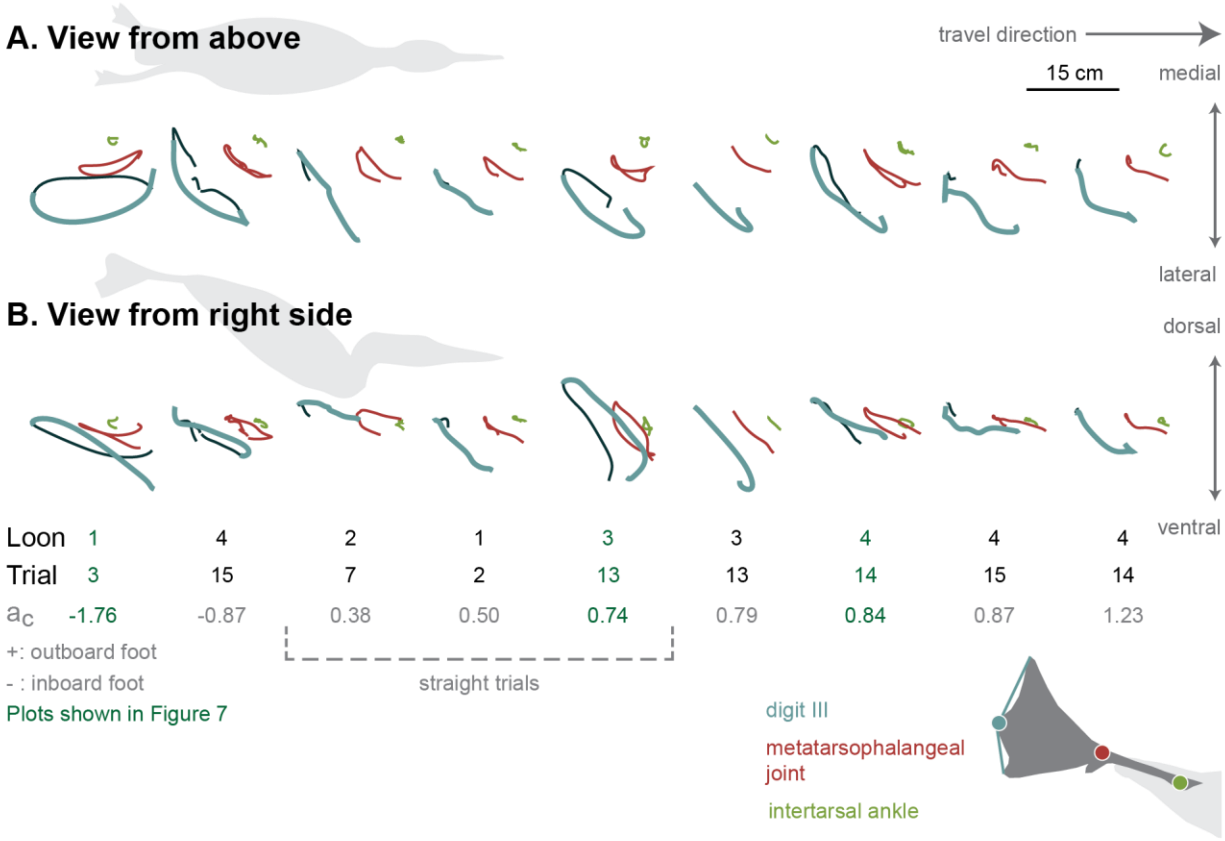


Figure S4. Foot motion variability during straight swimming and turning. The traces show tracked motion *relative to the body* including the power stroke (thick, light turqoise) and recovery stroke (thin dark blue). Strides are arranged by turn centripetal force with outboard feet represented by negative acceleration values and inboard feet represented by positive values. To improve comparisons, all tracked left feet have been reflected across the sagittal plane to appear as right feet. The 3D data are rotated to be in reference to the travel direction (x-axis), mediolateral plane (A, y-axis), and dorsoventral plane (B, y-axis) and translated to account for body motion. (A) View of the 'right' limb from above the loon showing the intertarsal ankle joint (green), metatarsophalangeal joint (MTP, red), and tip of digit III (blue). (B) View of the 'right' limb from the right side of the loon. All panels scaled to 15 cm scale bar. Trial information listed in dark green represents trials represented in Figure 7.

Table S1. Stride turning parameters in the horizontal plane. In 19 trials with body tracking, a circle was fit to the horizontal trajectory during each stride with at least 30% of the stride tracked. The circle fit provided an average radius of curvature, *r*, which was used to calculate average angular velocity, ω, and average centripetal acceleration a_c. The tangential acceleration, a_t, is defined as $a_t = r * \alpha$, where α is the average angular acceleration. α was calculated by finding the average $\Delta(\omega_{instantaneous})/\Delta t = \Delta(u_{instantaneous})/(r*\Delta t)$. The tracked foot column identifies 9 strides with reliable 3D foot tracking of an inboard (IB), outboard (OB) or straight swimming (SS) stride. The average stride duration of both limbs is shown for each stride when available.

Loon	Trial	*r* (m)	*u* (m s^{-1})	ω (deg s^{-1})	a_c (m s^{-2})	a_t (m s^{-2})	tracked feet	st. dur (s)
1	1	0.448	0.54	68.39	0.639	0.074		0.68
		0.458	0.52	65.07	0.590	0.123		0.62
	2	0.207	0.48	132.18	1.100	-0.023		0.54
		0.475	0.49	58.75	0.499	0.156	SS	0.69
	3	0.228	0.61	153.70	1.638	-1.782		0.33
		0.095	0.41	246.93	1.762	-0.215	OB	0.30
	4	0.274	0.36	74.85	0.467	-0.563		0.51
		0.404	0.40	56.27	0.389	0.019		0.57
		0.549	0.45	46.94	0.368	1.153		0.61
2	5	0.269	0.64	136.68	1.530	-0.585		0.69
		2.908	0.64	12.53	0.139	-0.010		0.89
	6	0.395	0.54	77.61	0.726	-0.407		0.75
		0.240	0.55	130.49	1.245	0.680		0.39
	7	0.860	0.57	37.91	0.376	0.033	SS	0.98
	8	0.449	0.70	89.61	1.097	-1.057		0.28
		0.122	0.44	204.57	1.559	-0.618		0.56
	9	0.463	0.55	67.46	0.642	-0.109		1.08
3	10	0.428	0.26	35.00	0.160	-0.999		
		0.339	0.30	50.26	0.261	0.412		0.46
	11	1.518	0.59	22.26	0.229	1.501		0.43
	12	1.860	0.50	15.26	0.132	-0.657		0.52
	13	0.311	0.31	57.68	0.315	-0.184		0.42
		0.271	0.45	95.03	0.745	0.218	SS	0.42
		0.179	0.38	120.08	0.788	-0.105	IB	0.43
		0.300	0.36	69.37	0.440	0.713		0.50
4	14	0.491	0.64	75.05	0.842	0.136	IB	0.56
		0.306	0.61	115.11	1.234	0.173	IB	0.60
	15	0.252	0.49	110.23	0.934	0.123		0.64
		0.278	0.49	101.63	0.874	0.020	IB & OB	0.65
	16	0.178	0.59	188.30	1.928	-0.234		0.42
		0.230	0.66	164.67	1.904	0.367		0.42
	17	1.145	0.66	33.02	0.380	-0.420		0.30
		0.455	0.60	75.72	0.794	1.789		0.34
	18	6.588	0.55	4.83	0.047	-0.588		0.58
		0.589	0.45	44.08	0.349	-0.083		0.44
	19	0.061	0.31	287.49	1.545	1.053		0.53

Table S2. Means and standard errors of kinematic parameters of loon swimming. In 19 recorded trials of loons swimming freely underwater the timing of foot paddling and body speed were tracked. The table shows the average and error values for several kinematic parameters for all strides and decomposed into three swim-type categories: strides where the loon was swimming straight, turning strides with the inboard foot tracked, and turning strides with the outboard foot tracked. The n columns show how many strides were analyzed for each kinematic parameter and swim-type category.

	All trials			Straight Strides			Inboard Foot			Outboard Foot		
	n	Mean	Std. Error	n	Mean	Std. Error	n	Mean	Std. Error	n	Mean	Std. Error
Power stroke time (s)	112	0.265	0.005	32	0.258	0.006	40	0.279	0.011	40	0.2568	0.008
Stride time (s)	80	0.546	0.020	26	0.487	0.032	28	0.578	0.036	26	0.569	0.032
Duty factor	77	0.513	0.015	24	0.542	0.024	27	0.521	0.029	26	0.478	0.023
Stride speed (m s^{-1})	23	0.542	0.031	9	0.484	0.053	5	0.637	0.076	9	0.546	0.035

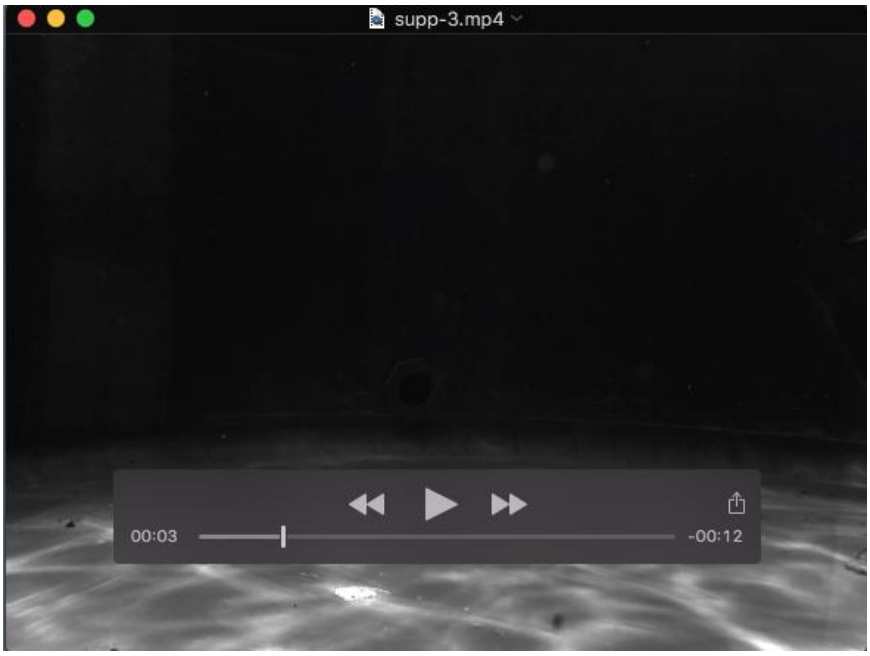
Table S3. Likelihood ratio tests for linear mixed effects models of loon swimming kinematic parameters. To account for swim-type category, stride body speed, and individual loon variation, linear mixed-error models were applied to kinematic parameters. Swim-type category (straight swimming strides, turning strides tracking the inboard foot, and turning strides tracking the outboard foot) and stride body speed were fixed effects, with loon identity as a random effect. Likelihood ratio tests compared full models to a model with either the swim-type or speed effect removed, calculating a p-value representing the influence of that effect on the kinematic parameter. These values are listed in the table (all non-"n" columns). Bold p-values denote significance using a 0.05 cut-off.

	straight vs. inboard vs. outboard			**straight vs. inboard**			**straight vs. outboard**			**inboard vs. outboard**			**straight vs. turning (in- + outboard)**		
	n	**swim type**	**speed**	**n**	**swim type**	**speed**	**n**	**swim type**	**speed**	**n**	**swim type**	**speed**	**n**	**swim type**	**speed**
Power stroke time (s)	40	1	**3.5e-5**	28	**0.007**	**2.5e-5**	26	1	**0.018**	26	0.156	**6.1e-7**	40	1	**1.4e-5**
Stride time (s)	42	1	**0.004**	30	1	**0.005**	28	1	0.134	26	1	**0.028**	42	1	**0.003**
Duty factor	40	1	1	28	0.148	0.890	26	1	0.330	26	1	1	40	1	1

Table S4. Digit III speed and travel distance during straight and turning strokes. The total distance traveled and average speed of the tip of digit III was calculated for 9 strokes, three during straight swimming and six while turning.

	Loon	Trial	a_c (m s^{-2})	Dig III distance (m)	Digiti III speed (m/s)
Straight	1	2	0.499	0.1460	0.5120
	2	7	0.376	0.1966	0.6049
	3	13	0.745	0.2437	0.9025
mean				*0.1954*	*0.6731*
Inboard foot	3	13	0.788	0.1978	0.9418
	4	14	0.842	0.2181	0.7270
	4	14	1.234	0.1820	0.7582
	4	15	0.874	0.2067	0.5370
mean				*0.2011*	*0.7410*
Outboard foot	1	3	1.762	0.2379	1.2197
	4	15	0.874	0.2337	0.8989
mean				*0.2358*	*1.0593*

Movie S1 – Underwater swimming by a common loon. The loon was filmed in a rehabilitation pool at the Tufts Wildlife Clinic. Footage was recorded at 200fps and is played back at 30fps, appearing 6.7 times slower than real life.



Movie S2 – Head-bobbing by a diving common loon. The loon was filmed in a rehabilitation pool at the Tufts Wildlife Clinic. Footage was recorded at 200fps and is played back at 30fps, appearing 6.7 times slower than real life.

Movie S3 – Tracked maneuvers by diving common loons. The loons were filmed in a rehabilitation pool at the Tufts Wildlife Clinic. Footage was recorded at 200fps and is played back at 30fps, appearing 6.7 times slower than real life. All clips have been digitally tracked for body motion or body and foot motion.