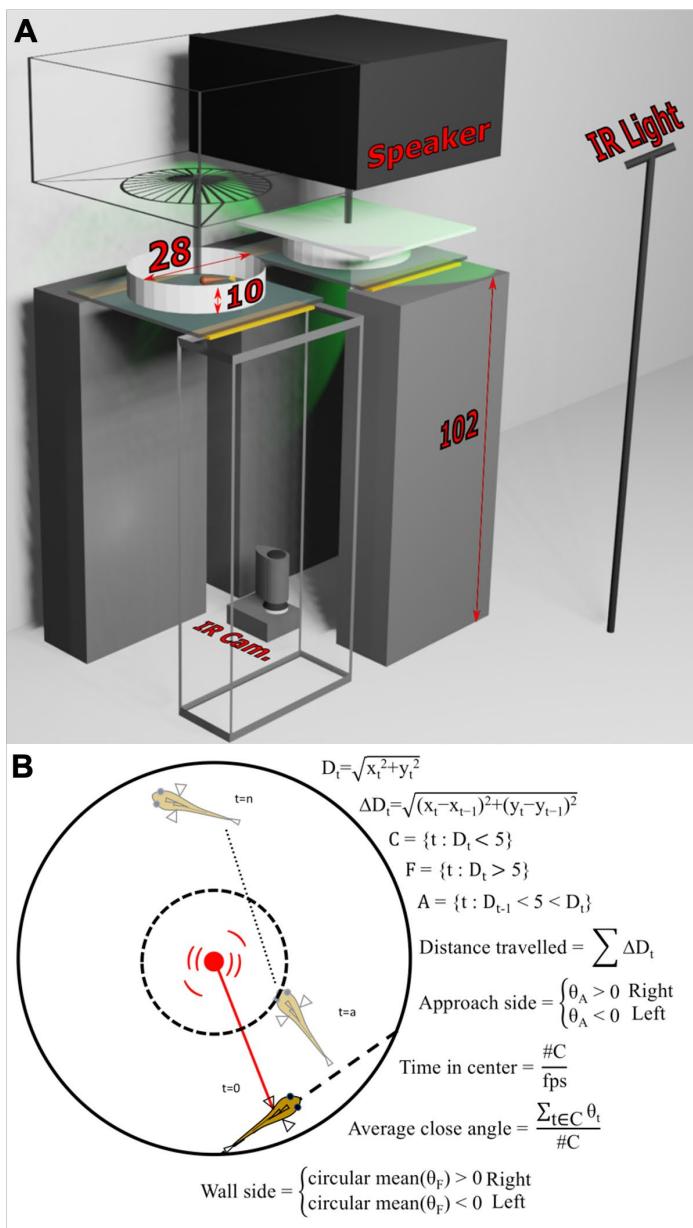
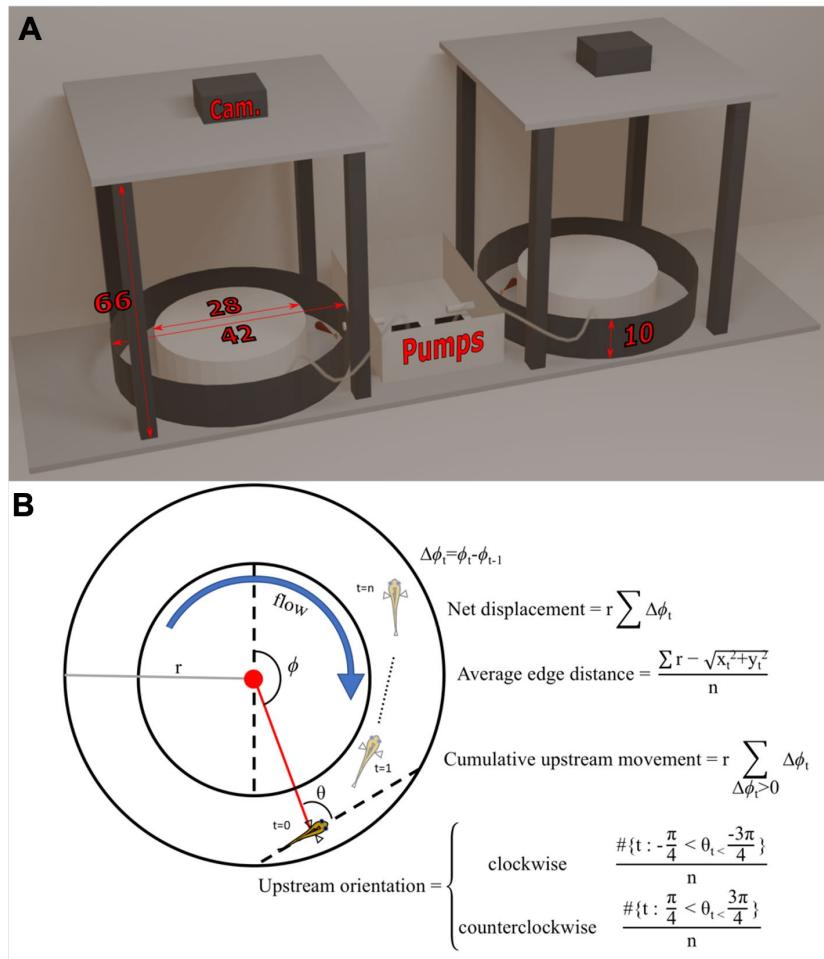


**Fig. S1.** (A) Schematic of predator evasion testing apparatus. All distances shown are in cm. The front cover from the left tank has been removed for visibility. The inset figure is an image of the source of the simulated predatory stimuli. (B) The sequence of functions applied to raw tracking data to correct for camera angle. (C) Diagram of how angles and distances were calculated during the analysis of footage,  $t$  = frame number with the first frame that the drop hit the water's surface being 0. The red point is the drop, the blue point is the position of the snout, and the green dot is the position of the mid-section. Note that  $\theta_t$  is bound between  $[-\pi, \pi]$  and rotations with a magnitude greater than  $\pi$  never occurred within a single frame (D) Diagram of a predator evasion event. The red dot is the drop. (E) Equations used to calculate kinematics for analysis. TTE = time to escape, fps = frames per second,  $(n : X)$  is the set of all  $n$  for which  $X$  is satisfied.



**Fig. S2.** (A) Schematic of vibration attraction behaviour (VAB) testing apparatus. The front support, front infrared (IR) light, half the speaker and the first tank's lid have been removed for visibility. Vibration absorbing foam is shown in yellow. All distances given are in cm. (B) Diagram of how kinematics were calculated for vibration attraction behaviour experiment. The first frame that the tip of a stickleback's snout enters within 5 cm of the center rod is  $t=a$ . fps = frames per second. ( $n : X$ ) is the set of all  $n$  for which equation  $X$  is satisfied.  $\#C$  is the cardinality of set  $C$ , in this case, the number of frames where the fish's snout was within 5 cm of the glass rod. Circular mean was calculated using the `mean.circular` function in the R package *circular* (Agostinelli and Lund 2017).



**Fig. S3.** (A) Schematic of rheotaxis testing apparatus. All distances given are in cm. (B) Diagram of how kinematics were calculated for rheotaxis experiment. ( $n : X$ ) is the set of all  $n$  for which  $X$  is satisfied.  $\#T$  is the cardinality of set  $T$ .

**Table S1. Counterbalancing of vibration attraction behaviour (VAB), rheotaxis and simulated predator evasion experiments.** Numbers in the VAB table are fish's within-group IDs with the stimuli frequencies in brackets (first/second). Numbers in the rheotaxis table and predator evasion table are also fish's within-group IDs, with the letters in the predator evasion table indicating the side of the first drop for that trial.

VAB	Trial	Test seq	Tank 1	Tank 1	Tank 2	Tank 3
			(1st fill)	(2nd fill)		
<i>a</i>	1st		1(20/60)	3 (60/20)	1 (20/60)	2 (20/60)
	2nd		2 (60/20)	4 (20/60)	3 (60/20)	4 (60/20)
<i>b</i>	1st		4 (60/20)	2 (20/60)	4 (20/60)	3 (20/60)
	2nd		3 (20/60)	1 (60/20)	2 (60/20)	1 (60/20)
<i>c</i>	1st		3 (60/20)	4 (20/60)	2 (20/60)	1 (20/60)
	2nd		1 (20/60)	2 (60/20)	4 (60/20)	3 (60/20)
<i>d</i>	1st		2 (20/60)	1 (60/20)	3 (20/60)	4 (20/60)
	2nd		4 (60/20)	3 (20/60)	1 (60/20)	2 (60/20)
Rheotaxis	Trial	Test seq	Track 1 (C)	Track 2 (CC)		
<i>a</i>	1st		1	2		
	2nd		3	4		
<i>b</i>	1st		4	3		
	2nd		2	1		
<i>c</i>	1st		2	1		
	2nd		4	3		
<i>d</i>	1st		3	4		
	2nd		1	2		
Predator	Trial	Test seq	Arena 1	Arena 2		
<i>a</i>	1st		3R	4L		
	2nd		1L	2R		

<i>b</i>	1st	2L	1R
	2nd	4R	3L
<i>c</i>	1st	4L	3R
	2nd	2R	1L
<i>d</i>	1st	1R	2L
	2nd	3L	4R

**Table S2. Eagle's Lake stickleback morphology.** All values are presented as mean  $\pm$  s.d.

[min,max]. DA = directional asymmetry (R - L), NC = neuromast count, LP = lateral plate count, SL = standard length, all neuromast stitch abbreviations (rows ET through CF) are as in Fig 2.

Note counts are totals of both sides of the body.

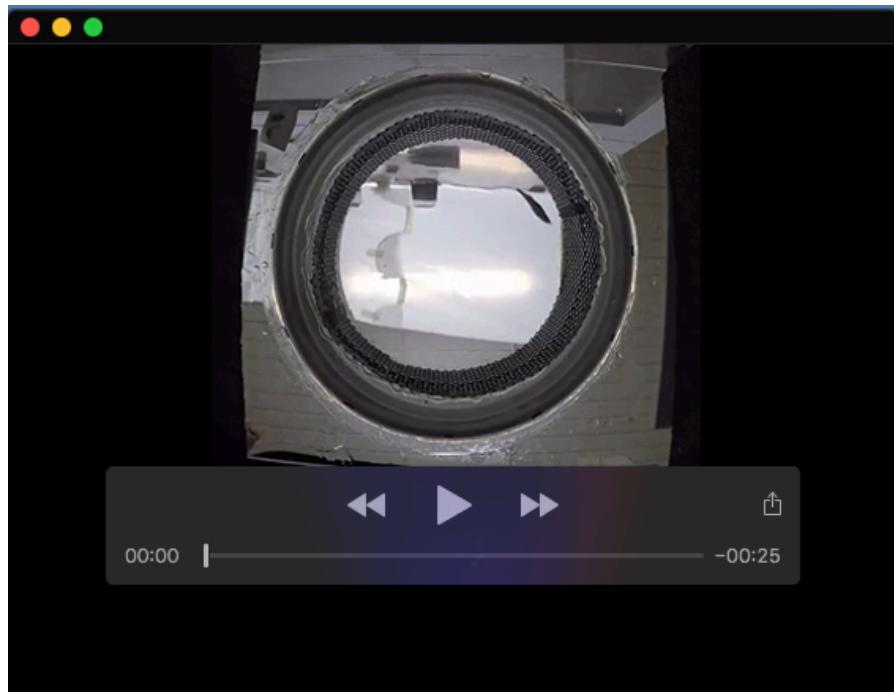
Females (n = 25)		Males (n = 15)		
Trait	Count / Measure	DA	Count / Measure	DA
ET	14.6 $\pm$ 3.3, [3,19]	-0.1 $\pm$ 1.9, [-4,3]	15.4 $\pm$ 1.7, [12,18]	0.2 $\pm$ 1.8, [-2,4]
SO	55.1 $\pm$ 7.5, [36,66]	-0.3 $\pm$ 2.6, [-6,5]	56.9 $\pm$ 5.4, [46,66]	0.6 $\pm$ 2.3, [-4,3]
AP	19.5 $\pm$ 4.5, [7,26]	0.8 $\pm$ 2.5, [-5,6]	17.2 $\pm$ 6, [4,26]	0.7 $\pm$ 3.2, [-5,7]
OT	22 $\pm$ 3.9, [11,28]	0.8 $\pm$ 1.9, [-2,5]	22.1 $\pm$ 3.7, [15,28]	-0.3 $\pm$ 2.2, [-5,5]
ST	36.4 $\pm$ 8.9, [14,59]	-0.3 $\pm$ 4.4, [-8,11]	34.7 $\pm$ 6.4, [18,43]	0.7 $\pm$ 3.2, [-6,6]
IO	63.1 $\pm$ 8.8, [40,80]	0.4 $\pm$ 4.4, [-7,10]	63 $\pm$ 8, [46,74]	-0.2 $\pm$ 3.3, [-6,8]
OR	7.8 $\pm$ 4.3, [0,18]	-0.6 $\pm$ 3.1, [-10,6]	8.5 $\pm$ 5.4, [0,20]	-0.1 $\pm$ 2.3, [-4,4]
MD1	4.8 $\pm$ 5.3, [0,16]	0 $\pm$ 1.6, [-3,4]	10.7 $\pm$ 7.6, [0,20]	-0.4 $\pm$ 3.4, [-11,5]
MD2	40.2 $\pm$ 5, [30,49]	0.4 $\pm$ 3.8, [-9,7]	46.6 $\pm$ 8.7, [38,73]	1.9 $\pm$ 7.4, [-6,25]
PO	40.6 $\pm$ 5, [26,47]	-0.3 $\pm$ 1.8, [-4,3]	39.9 $\pm$ 3.7, [34,46]	-1.1 $\pm$ 2.8, [-7,4]
Ma	60.9 $\pm$ 17.6, [30,99]	2.3 $\pm$ 4.9, [-6,10]	54.9 $\pm$ 22.3, [0,91]	1.9 $\pm$ 3.6, [-3,11]
Mp	87.7 $\pm$ 40.1, [33,189]	-4.4 $\pm$ 10.9, [-34,10]	78.3 $\pm$ 45.4, [18,177]	-2.5 $\pm$ 8.3, [-22,11]
CF	0 $\pm$ 0, [0,0]	0 $\pm$ 0, [0,0]	0.7 $\pm$ 2, [0,7]	0.2 $\pm$ 1.1, [-1,4]
NC	452.7 $\pm$ 80.7, [262,587]	-1.4 $\pm$ 14.4, [-40,22]	448.9 $\pm$ 86.6, [300,609]	1.6 $\pm$ 13.7, [-23,28]
LP	18.7 $\pm$ 12.6, [11,64]	0.3 $\pm$ 1.6, [-2,7]	14.6 $\pm$ 1.1, [13,17]	0.1 $\pm$ 0.6, [-1,1]
SL	49.1 $\pm$ 5.8, [40,57]		43.7 $\pm$ 5.6, [36,53]	

**Table S3. Effects of individual stitches on behaviour.** Adjusted p-values have been Bonferroni adjusted for multiple comparisons ( $n = 13$ ). Estimate is the effect size per neuromast, whereas scaled estimate is the effect size per standard deviation of neuromast counts for that stitch. Estimates are given in log-odds for all behaviors except max velocity for which estimates are slopes of a linear regression of  $\log(\text{max velocity})$ . Stitches with significant effect are underlined and stitches with significant effect after correcting for multiple comparisons are also bolded.

Behaviour	Predictor	Stitch	$\chi^2$	p (adjusted)	estim. $\pm$ se	scaled estim. $\pm$ se
Wall side (Pred.)	Neuromasts	AP	2.57	0.109 (1)	-0.037 $\pm$ 0.023	-0.209 $\pm$ 0.13
		SO	1.56	0.212 (1)	-0.022 $\pm$ 0.018	-0.159 $\pm$ 0.128
		ET	0.21	0.646 (1)	-0.02 $\pm$ 0.043	-0.061 $\pm$ 0.132
		IO	2.55	0.11 (1)	-0.023 $\pm$ 0.014	-0.192 $\pm$ 0.12
		OR	1.35	0.246 (1)	-0.029 $\pm$ 0.025	-0.139 $\pm$ 0.12
		MD1	0.46	0.497 (1)	-0.012 $\pm$ 0.018	-0.083 $\pm$ 0.122
		MD2	2.08	0.149 (1)	0.024 $\pm$ 0.017	0.184 $\pm$ 0.127
		PO	2.19	0.139 (1)	-0.039 $\pm$ 0.026	-0.174 $\pm$ 0.118
		OT	1.3	0.254 (1)	-0.036 $\pm$ 0.032	-0.138 $\pm$ 0.121
		ST	2.37	0.124 (1)	-0.023 $\pm$ 0.015	-0.19 $\pm$ 0.123
		Ma	2.38	0.123 (1)	-0.009 $\pm$ 0.006	-0.197 $\pm$ 0.127
		<b>Mp</b>	<b>10.83</b>	<b>0.001 (0.013)</b>	<b>-0.008 <math>\pm</math> 0.003</b>	<b>-0.369 <math>\pm</math> 0.112</b>
		CF	0.07	0.785 (1)	-0.026 $\pm$ 0.096	-0.041 $\pm$ 0.149
Escape %	Neuromasts	AP	4.82	0.028 (0.365)	-0.066 $\pm$ 0.03	-0.396 $\pm$ 0.18
		<u>SO</u>	<u>4.01</u>	<u>0.045 (0.589)</u>	<u>-0.046 <math>\pm</math> 0.023</u>	<u>-0.349 <math>\pm</math> 0.175</u>
		ET	2.72	0.099 (1)	-0.091 $\pm$ 0.055	-0.341 $\pm$ 0.206
		<u>IO</u>	<u>4.77</u>	<u>0.029 (0.376)</u>	<u>-0.041 <math>\pm</math> 0.019</u>	<u>-0.337 <math>\pm</math> 0.154</u>
		<u>OR</u>	<u>3.86</u>	<u>0.05 (0.644)</u>	<u>-0.066 <math>\pm</math> 0.033</u>	<u>-0.328 <math>\pm</math> 0.167</u>
		MD1	3.6	0.058 (0.752)	-0.045 $\pm$ 0.024	-0.304 $\pm$ 0.16
		MD2	0.06	0.809 (1)	-0.006 $\pm$ 0.023	-0.045 $\pm$ 0.186
		PO	3.36	0.067 (0.866)	-0.065 $\pm$ 0.036	-0.283 $\pm$ 0.154
		OT	0.87	0.352 (1)	-0.041 $\pm$ 0.044	-0.147 $\pm$ 0.159
		ST	1.64	0.2 (1)	-0.027 $\pm$ 0.021	-0.203 $\pm$ 0.158
		Ma	0.82	0.366 (1)	-0.008 $\pm$ 0.008	-0.161 $\pm$ 0.178
		Mp	0.7	0.404 (1)	-0.003 $\pm$ 0.004	-0.147 $\pm$ 0.176
		CF	1.37	0.241 (1)	0.146 $\pm$ 0.125	0.24 $\pm$ 0.205
Escape %	Neuromasts	AP	2.88	0.09 (1)	-0.048 $\pm$ 0.028	-0.139 $\pm$ 0.082
		X Drop side	SO	3.65	0.056 (0.728)	-0.043 $\pm$ 0.022
		ET	0	0.947 (1)	-0.003 $\pm$ 0.049	
		<u>IO</u>	<u>4.83</u>	<u>0.028 (0.364)</u>	<u>-0.043 <math>\pm</math> 0.019</u>	
		OR	0.58	0.446 (1)	-0.025 $\pm$ 0.033	

		MD1	0.51	0.475 (1)	-0.017 ± 0.024	-0.047 ± 0.065
		<u>MD2</u>	<u>0.05</u>	<u>0.824 (1)</u>	<u>0.005 ± 0.021</u>	<u>0.027 ± 0.123</u>
		PO	0.63	0.427 (1)	0.028 ± 0.035	0.072 ± 0.091
		<u>OT</u>	<u>4.22</u>	<u>0.04 (0.519)</u>	<u>-0.089 ± 0.043</u>	<u>-0.207 ± 0.101</u>
		<u>ST</u>	<u>5.02</u>	<u>0.025 (0.325)</u>	<u>-0.047 ± 0.021</u>	<u>-0.192 ± 0.086</u>
		<u>Ma</u>	<u>5.01</u>	<u>0.025 (0.328)</u>	<u>-0.018 ± 0.008</u>	<u>-0.072 ± 0.032</u>
		Mp	3.58	0.059 (0.762)	-0.007 ± 0.004	-0.07 ± 0.037
		CF	3.8	0.051 (0.665)	-0.222 ± 0.114	-0.112 ± 0.058
Max velocity	Neuromasts	AP	0.44	0.506 (1)	-0.005 ± 0.008	-0.031 ± 0.046
		SO	5.52	0.019 (0.244)	-0.013 ± 0.005	-0.095 ± 0.04
		ET	3.73	0.054 (0.696)	-0.025 ± 0.013	-0.092 ± 0.048
		<u>IO</u>	<u>3.83</u>	<u>0.05 (0.654)</u>	<u>-0.009 ± 0.005</u>	<u>-0.074 ± 0.038</u>
		OR	0.81	0.367 (1)	-0.008 ± 0.009	-0.039 ± 0.043
		<u>MD1</u>	<u>4.14</u>	<u>0.042 (0.546)</u>	<u>-0.012 ± 0.006</u>	<u>-0.081 ± 0.04</u>
		MD2	0.07	0.786 (1)	0.002 ± 0.006	0.013 ± 0.046
		PO	1.11	0.292 (1)	-0.01 ± 0.009	-0.041 ± 0.039
		OT	0	0.952 (1)	-0.001 ± 0.011	-0.002 ± 0.041
		<u>ST</u>	<u>8.53</u>	<u>0.004 (0.046)</u>	<u>-0.014 ± 0.005</u>	<u>-0.104 ± 0.036</u>
		<u>Ma</u>	<u>11.91</u>	<u>0.001 (0.007)</u>	<u>-0.006 ± 0.002</u>	<u>-0.13 ± 0.038</u>
		Mp	1.92	0.166 (1)	-0.001 ± 0.001	-0.058 ± 0.042
		CF	1.1	0.294 (1)	-0.031 ± 0.029	-0.051 ± 0.048
Max velocity	DA	AP	1.59	0.208 (1)	-0.019 ± 0.015	-0.056 ± 0.045
		SO	0.27	0.604 (1)	0.009 ± 0.018	0.022 ± 0.042
		ET	0.84	0.361 (1)	-0.02 ± 0.022	-0.04 ± 0.044
		<u>IO</u>	<u>9.93</u>	<u>0.002 (0.021)</u>	<u>0.03 ± 0.01</u>	<u>0.114 ± 0.036</u>
		<u>OR</u>	<u>5.17</u>	<u>0.023 (0.298)</u>	<u>0.034 ± 0.015</u>	<u>0.082 ± 0.036</u>
		MD1	1.71	0.191 (1)	0.022 ± 0.017	0.061 ± 0.046
		<u>MD2</u>	<u>7.77</u>	<u>0.005 (0.069)</u>	<u>0.018 ± 0.006</u>	<u>0.107 ± 0.039</u>
		PO	0.33	0.568 (1)	-0.01 ± 0.018	-0.027 ± 0.047
		OT	0.31	0.581 (1)	-0.011 ± 0.02	-0.026 ± 0.046
		ST	0.13	0.714 (1)	0.004 ± 0.011	0.016 ± 0.044
		Ma	0.48	0.488 (1)	-0.007 ± 0.01	-0.027 ± 0.039
		Mp	0.12	0.729 (1)	0.001 ± 0.004	0.014 ± 0.041
		CF	0.44	0.509 (1)	0.044 ± 0.067	0.023 ± 0.034
Wall side (VAB)	Neuromasts	AP	0.03	0.871 (1)	0.004 ± 0.026	0.024 ± 0.146
		SO	2.14	0.143 (1)	0.029 ± 0.02	0.205 ± 0.14
		<u>ET</u>	<u>9.37</u>	<u>0.002 (0.029)</u>	<u>0.143 ± 0.047</u>	<u>0.445 ± 0.145</u>
		IO	2.65	0.104 (1)	0.025 ± 0.015	0.213 ± 0.131
		OR	1.53	0.217 (1)	0.034 ± 0.028	0.162 ± 0.131
		MD1	0.26	0.609 (1)	0.01 ± 0.02	0.068 ± 0.134

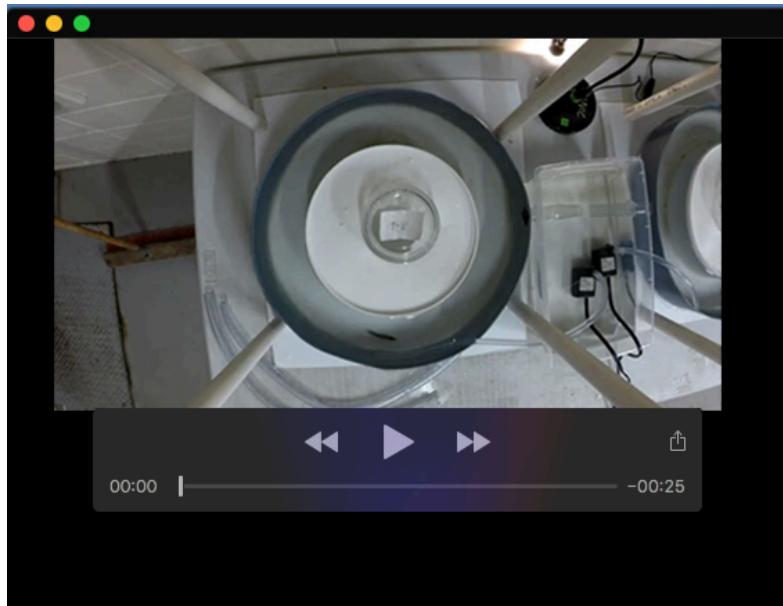
MD2	0.12	0.732 (1)	-0.006 ± 0.019	-0.048 ± 0.141
PO	0.04	0.842 (1)	-0.006 ± 0.03	-0.027 ± 0.133
OT	0.04	0.838 (1)	-0.007 ± 0.036	-0.028 ± 0.136
ST	3.4	0.065 (0.849)	0.03 ± 0.016	0.248 ± 0.134
<b>Ma</b>	<b>9.78</b>	<b>0.002 (0.023)</b>	<b>0.02 ± 0.006</b>	<b>0.412 ± 0.132</b>
Mp	2.14	0.143 (1)	0.005 ± 0.003	0.199 ± 0.136
CF	0.06	0.814 (1)	-0.026 ± 0.109	-0.04 ± 0.168



**Movie 1.** Evasion response to first drop of a simulated predator attack. Shot at 60 fps.



**Movie 2.** Vibration attraction behaviour control trial. Time lapse shot at 0.667 fps, played back at 30 fps.



**Movie 3.** Clockwise rheotaxis behaviour trial. Time lapse shot at 0.667 fps, played back at 30 fps.