



**Movie 1. Sea otter's behavioral strategy for paw and vibrissal texture discrimination in air and under water.** Video footage of the sea otter interacting with stimulus combinations. For each experimental condition, two trials are shown at full speed and  $\frac{1}{4}$ -speed. The sea otter chooses correctly each trial. These trials are representative of her tendencies to explore the right stimulus first and not compare stimuli before making a choice. Video collection authorized under USFWS research permit MA186914-2.

**Table S1.** Means and 95% credible intervals for parameter estimates of Bayesian models.

Model	Parameter	Mean(s)	CI(s)
<b>Paw (grouped air and water)</b>	$\alpha_{paw}$	<b>0.29</b>	<b>0.23 - 0.34</b>
<b>Vibrissae (grouped air and water)</b>	$\alpha_{vibrissae}$	<b>0.51</b>	<b>0.42 - 0.63</b>
	$\beta_{paw}$	<b>7.50</b>	<b>1.35 - 20.63</b>
	$\beta_{vibrissae}$	<b>6.29</b>	<b>1.46 - 14.44</b>
	$\lambda$	<b>0.013</b>	<b>0.00047 - 0.030</b>
	$\sigma$	<b>0.097</b>	<b>0.000078 - 0.23</b>
<b>Paw (air and water separate)</b>	$\alpha_{paw, air}$	<b>0.26</b>	<b>0.19 - 0.34</b>
<b>Vibrissae (grouped air and water)</b>	$\alpha_{paw, water}$	<b>0.31</b>	<b>0.24 - 0.38</b>
	$\alpha_{vibrissae}$	<b>0.51</b>	<b>0.42 - 0.63</b>
	$\beta_{paw, air}$	<b>8.07</b>	<b>0.82 - 24.1</b>
	$\beta_{paw, water}$	<b>13.05</b>	<b>1.29 - 34.1</b>
	$\beta_{vibrissae}$	<b>6.29</b>	<b>1.39 - 14.47</b>
	$\lambda$	<b>0.014</b>	<b>0.0003 - 0.032</b>
	$\sigma$	<b>0.102</b>	<b>0.00066 - 0.24</b>
Paw (grouped air and water)	$\alpha_{paw}$	0.29	0.23 - 0.34
Vibrissae (air and water separate)	$\alpha_{vibrissae, air}$	0.52	0.37 - 0.73
	$\alpha_{vibrissae, water}$	0.55	0.39 - 0.78
	$\beta_{paw}$	7.63	1.40 - 21.08
	$\beta_{vibrissae, air}$	10.09	0.83 - 27.72
	$\beta_{vibrissae, water}$	7.53	0.92 - 21.72
	$\lambda$	0.013	0.0002 - 0.031
	$\sigma$	0.11	0.00032 - 0.25

Paw (air and water separate)	$\alpha_{\text{paw, air}}$	0.26	0.18 - 0.33
Vibrissae (air and water separate)	$\alpha_{\text{paw, water}}$	0.31	0.24 - 0.39
	$\alpha_{\text{vibrissae, air}}$	0.53	0.39 - 0.74
	$\alpha_{\text{vibrissae, water}}$	0.56	0.39 - 0.79
	$\beta_{\text{paw, air}}$	8.26	0.98 - 24.94
	$\beta_{\text{paw, water}}$	13.21	1.13 - 34.12
	$\beta_{\text{vibrissae, air}}$	10.23	0.87 - 28.04
	$\beta_{\text{vibrissae, water}}$	7.71	0.81 - 22.43
	$\lambda$	0.014	0.00022 - 0.033
	$\sigma$	0.12	0.00048 - 0.27
<hr/>			
Grouped tactile structures	$\alpha$	0.39	0.31 - 0.47
[paw (in air and under water) and	$\beta$	4.89	1.88 - 9.27
vibrissae (in air and under water)]	$\lambda$	0.015	0.00044 - 0.035
	$\sigma$	0.31	0.11 - 0.54

The two best-supported models are in bolded italics.

**Table S2.** Results from GLMM model selection for sea otter strategy: number of discrete exploratory touches, number of stimulus comparisons, and decision time (ms).

Model No.	Intercept	Str <sub>v</sub>	Med <sub>uw</sub>	Str <sub>v</sub> x Med <sub>uw</sub>	Diff <sub>nt</sub>	Diff <sub>nt</sub> x Str <sub>v</sub>	Diff <sub>nt</sub> x Med <sub>uw</sub>	AICc	ΔAICc	AIC weight
<i>Number of discrete exploratory touches</i>										
1	<b>1.05</b>	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	<b>534.23</b>	<b>0.00</b>	<b>0.78</b>
2	1.06	0.96	0.96	1.14	n.i.	n.i.	n.i.	540.06	5.83	0.04
3	1.02	1.08	n.i.	n.i.	1.05	0.90	n.i.	540.20	5.97	0.04
4	1.03	1.03	1.02	n.i.	0.99	n.i.	n.i.	540.35	6.12	0.04
5	1.03	n.i.	1.05	n.i.	1.02	n.i.	0.96	540.35	6.12	0.04
6	1.07	0.96	0.96	1.14	0.99	n.i.	n.i.	542.15	7.92	0.01
7	1.004	1.08	1.02	n.i.	1.05	0.90	n.i.	542.27	8.04	0.01
8	1.02	1.02	1.05	n.i.	1.02	n.i.	0.96	542.42	8.19	0.01
9	1.04	1.01	0.96	1.14	1.05	0.90	n.i.	544.08	9.85	0.01
10	1.05	0.96	0.98	1.14	1.02	n.i.	0.96	544.23	10.00	0.01
11	0.99	1.08	1.05	n.i.	1.07	0.90	0.96	544.35	10.12	0.00
12	1.03	1.01	0.98	1.14	1.07	0.90	0.96	546.19	11.96	0.00
<b>Importance</b>	<b>0.18</b>	<b>0.18</b>	<b>0.07</b>	<b>0.17</b>	<b>0.07</b>	<b>0.06</b>				
<i>Number of stimulus comparisons</i>										
1	0.06	0.25	0.25	28	n.i.	n.i.	n.i.	107.4	0.00	0.21
2	0.04	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	107.6	0.18	0.19
3	0.03	0.94	0.25	28	4.00	0.08	n.i.	107.6	0.19	0.19
4	0.03	~1	~0	7.17e8	3.00	0	4.78e7	108.6	1.20	0.12
5	0.01	6.19	n.i.	n.i.	4.00	0.08	n.i.	109.3	1.85	0.08
6	0.07	0.25	0.25	28	0.86	n.i.	n.i.	109.4	2.02	0.08
7	0.05	0.25	0.39	28	1.50	n.i.	0.4	110.9	3.50	0.04
8	0.01	5.81	1.55	n.i.	4.00	0.08	n.i.	111.0	3.56	0.04
9	0.02	n.i.	2.58	n.i.	1.50	n.i.	0.4	112.6	5.16	0.02
10	0.03	1.55	1.55	n.i.	0.86	n.i.	n.i.	112.8	5.41	0.01
11	0.01	5.58	2.09	n.i.	5.50	0.09	0.55	112.9	5.46	0.01
12	0.02	1.55	2.42	n.i.	1.50	n.i.	0.4	114.3	6.88	0.01
<b>Importance</b>	<b>0.79</b>	<b>0.72</b>	<b>0.64</b>	<b>0.59</b>	<b>0.44</b>	<b>0.19</b>				
<i>Decision time</i>										

1	130.5	1.22	1.95	1.37	0.83	n.i.	n.i.	3127.7	0.00	0.22
2	121.5	1.38	2.13	1.37	0.83	0.85	n.i.	3128.3	0.64	0.16
3	139.2	1.09	1.95	1.23	n.i.	n.i.	n.i.	3128.6	0.89	0.14
4	137.9	1.22	1.82	1.25	0.83	n.i.	1.13	3129.0	1.31	0.12
5	130.1	1.23	2.12	1.24	n.i.	0.86	n.i.	3129.3	1.63	0.10
6	128.3	1.36	2.00	1.26	0.83	0.86	1.11	3130.0	2.21	0.07
7	146.9	1.09	1.82	1.13	n.i.	n.i.	1.12	3130.0	2.26	0.07
8	152.9	n.i.	1.82	1.13	n.i.	n.i.	1.13	3130.3	2.62	0.06
9	137.3	1.23	1.98	1.13	n.i.	0.86	1.12	3130.7	2.99	0.05
10	146.1	1.23	2.09	n.i.	n.i.	0.87	n.i.	3142.7	15.0	1.21e-04
11	184.7	1.23	n.i.	1.33	0.81	n.i.	n.i.	3295.7	168.1	7.18e-38
12	224.0	n.i.	n.i.	n.i.	n.i.	n.i.	n.i.	3297.0	169.3	3.85e-38
<b>Importance</b>	<b>0.94</b>	<b>1.0</b>	<b>1.0</b>	<b>0.58</b>	<b>0.38</b>	<b>0.37</b>				

Fixed ( $\text{Diff}_{\text{nt}}$  = difficulty, near-threshold;  $\text{Str}_v$  = tactile structure, vibrissae;  $\text{Med}_{\text{uw}}$  = testing medium, under water) and interactive effects between the fixed effects were systematically removed to create the suite of models. Models are ranked according to the corrected Akaike information criterion (AICc). The AIC weight of each model and the relative importance of each variable (*i.e.*, the summed AIC weights of each model in which the variable is included) are listed as proportions. All model coefficients have been exponentiated for ease of interpretation. The intercept, therefore, represents the number of touches, stimulus comparisons, or decision time (ms) under the default values of the fixed effects (structure = paw, medium = in air, difficulty = supra-threshold). Other coefficients represent multipliers relative to the default values; “n.i.” indicates that the variable was not included in the model. Note that because the expected values are so close to 0, it is possible for the multipliers to be very large or very small. The best supported model for number of discrete exploratory touches, the null model, is bolded and italicized.

**Table S3. Results from GLMM model selection for sea otter strategy using her vibrissae: directional explorative touches.**

Model No.	Intercept	Med <sub>uw</sub>	Diff <sub>nt</sub>	Diff <sub>nt</sub> x Med <sub>uw</sub>	AICc	ΔAICc	AIC weight
1	1.60	1.40	n.i.	n.i.	373.90	0.00	0.48
2	1.66	1.40	0.93	n.i.	375.71	1.80	0.20
3	1.90	n.i.	n.i.	n.i.	376.13	2.23	0.16
4	1.56	1.56	1.06	0.80	377.11	3.21	0.10
5	1.97	n.i.	0.93	n.i.	377.90	4.00	0.07
<b>Importance</b>		<b>0.78</b>	<b>0.36</b>	<b>0.10</b>			

Fixed (Diff<sub>nt</sub> = difficulty, near-threshold; Med<sub>uw</sub> = testing medium, under water) and interactive effects between the fixed effects were systematically removed to create the suite of models. Models are ranked according to the corrected Akaike information criterion (AICc). The AIC weight of each model and the relative importance of each variable (*i.e.*, the summed AIC weights of each model in which the variable is included) are listed as proportions. All model coefficients have been exponentiated for ease of interpretation. The intercept, therefore, represents the number of directional touches under the default values of the fixed effects (medium = in air, difficulty = supra-threshold). Other coefficients represent multipliers relative to the default values; “n.i.” indicates that the variable was not included in the model.

**Table S4. Results from GLMM and GLM model comparison for human strategy: number of discrete exploratory touches, number of stimulus comparisons, and decision time (ms).**

Model No.	Model Type	Intercept	Diff <sub>nt</sub>	Subj <sub>DS</sub>	Subj <sub>JY</sub>	Subj <sub>KC</sub>	Diff <sub>nt</sub> x Subj <sub>DS</sub>	Diff <sub>nt</sub> x Subj <sub>JY</sub>	Diff <sub>nt</sub> x Subj <sub>KC</sub>	AICc	ΔAICc	AIC weight
<i>Number of discrete exploratory touches</i>												
1	GLM	<b>2.33</b>	<b>1.18</b>	<b>0.74</b>	<b>0.77</b>	<b>1.74</b>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<b>428.97</b>	<b>0.00</b>	<b>0.87</b>
2	GLM	2.5	1.03	0.70	0.80	1.45	1.12	0.91	1.40	433.17	4.20	0.11
3	GLMM	2.33	1.18	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	437.79	8.82	0.11
4	GLMM	2.53	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	437.97	9.00	0.0097
5	GLMM	2.39	1.12	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	442.41	13.43	0.0011
6	GLM	2.47	1.18	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	468.52	39.55	2.25e-09
<b>Importance</b>			<b>0.99</b>		<b>0.98</b>			<b>0.11</b>				
<i>Number of stimulus comparisons</i>												
1	GLM	<b>0.77</b>	<b>1.36</b>	<b>0.83</b>	<b>1.03</b>	<b>3.41</b>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<b>366.91</b>	<b>0.00</b>	<b>0.90</b>
2	GLM	0.81	1.23	0.77	1.23	2.92	1.14	0.71	1.30	371.44	4.54	0.09
3	GLMM	1.01	1.36	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	376.73	9.83	0.007
4	GLMM	1.19	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	378.96	12.05	0.002
5	GLMM	1.06	1.24	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	382.04	15.14	0.0005
6	GLM	1.20	1.36	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	432.62	65.71	4.83e-15
<b>Importance</b>			<b>1.0</b>		<b>0.99</b>			<b>0.09</b>				
<i>Decision time</i>												
1	GLM	<b>2391.6</b>	<b>1.38</b>	<b>1.27</b>	<b>0.33</b>	<b>4.85</b>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<b>2480.3</b>	<b>0.00</b>	<b>0.86</b>
2	GLM	2668.3	1.17	1.60	0.36	4.20	0.66	0.88	1.25	2483.9	3.64	0.14
3	GLMM	2857.3	1.38	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	2560.6	80.3	3.14e-18
4	GLMM	3471.9	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	2570.6	90.3	2.09e-20
5	GLM	4776.6	1.24	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	<i>n.i.</i>	2608.5	128.2	1.25e-28

6	GLMM	3319.7	1.08	n.i.	n.i.	n.i.	n.i.	n.i.	2628.4	148.1	6.01e-33
<b>Importance</b>			<b>1.0</b>		<b>1.0</b>			<b>0.14</b>			

The fixed effects ( $\text{Diff}_{\text{nt}}$  = difficulty, near-threshold,  $\text{Subj}_{\text{DS}}$  = subject (DS);  $\text{Subj}_{\text{JY}}$  = subject (JY);  $\text{Subj}_{\text{KC}}$  = subject (KC)) were systematically removed to create the suite of models. Models are ranked according to the corrected Akaike information criterion (AICc). The AIC weight of each model and the relative importance of each variable (*i.e.*, the summed AIC weights of each model in which the variable is included) are listed as proportions. All model coefficients have been exponentiated for ease of interpretation. The intercept, therefore, represents the number of touches, number of stimulus comparisons, or decision time (ms) under the default values of the fixed effects (difficulty = supra-threshold, subject = CM). Other coefficients represent multipliers relative to the default values; “n.i.” indicates that the variable was not included in the model. Model 3 and Model 5 differed with respect to the random effect—in Model 3, subject was included as a random effect, without an interaction with difficulty; in Model #3, the slope and intercept of each subject’s response to difficulty was allowed to vary. The best-supported model for each response variable is in bolded italics.

**Table S5. Results from GLMM and LMM model comparisons for sea otter and human: discrete exploratory touches, number of stimulus comparisons, and decision time (ms).**

Model No.	Intercept	Species <sub>so</sub>	Diff <sub>nt</sub>	Diff <sub>nt</sub> x Species <sub>so</sub>	AICc	ΔAICc	AIC weight
<i>Number of discrete exploratory touches (GLMM)</i>							
1	2.54	0.41	n.i.	n.i.	975.46	0.00	0.49
2	2.43	0.41	1.09	n.i.	976.32	0.86	0.32
3	2.34	0.45	1.18	0.84	977.29	1.83	0.20
4	1.61	n.i.	n.i.	n.i.	1031.16	55.70	3.93e-13
5	1.54	n.i.	1.09	n.i.	1032.00	56.50	2.58e-13
<b>Importance</b>	<b>1.0</b>	<b>0.51</b>	<b>0.20</b>				
<i>Number of stimulus comparisons (GLMM)</i>							
1	1.03	1.32	0.04	n.i.	487.68	0.00	0.52
2	1.01	1.36	0.05	0.63	489.09	1.41	0.26
3	1.20	n.i.	0.04	n.i.	489.38	1.70	0.22
4	0.18	1.32	n.i.	n.i.	549.52	61.84	1.94e-14
5	0.21	n.i.	n.i.	n.i.	551.24	63.56	8.21e-15
<b>Importance</b>	<b>0.78</b>	<b>1.0</b>	<b>0.26</b>				
<i>Decision time (LMM)</i>							
<b>1</b>	<b>2891.33</b>	<b>1.35</b>	<b>0.0006</b>	<b>98.37</b>	<b>7439.8</b>	<b>0.00</b>	<b>0.97</b>
2	2795.32	1.41	0.066	n.i.	7447.0	7.23	0.026
3	3431.33	n.i.	0.065	n.i.	7487.6	47.82	4.03e-11
4	720.11	1.39	n.i.	n.i.	7529.8	89.97	2.84e-20
5	876.76	n.i.	n.i.	n.i.	7569.3	129.46	7.51e-29
<b>Importance</b>	<b>1.0</b>	<b>1.0</b>	<b>0.97</b>				

The fixed effects (Diff<sub>nt</sub> = difficulty, near-threshold; Species<sub>so</sub>, sea otter) and interactive effects between the fixed effects were systematically removed to create the suite of models. Models are ranked according to the corrected Akaike information criterion (AICc). The AIC weight of each model and the relative importance of each variable (*i.e.*, the summed AIC weights of each model in which the variable is included) are listed as proportions. All model coefficients have been exponentiated for ease of interpretation. The intercept, therefore, represents the number of touches, stimulus comparisons, or the decision time (ms) under the default values of the fixed effects (species = human, difficulty = supra-threshold). Other coefficients represent multipliers relative to the default values; “n.i.” indicates that the variable was not included in the model. Note that because the expected value for sea otter is much smaller than that for human, the multipliers can be very large or very small. The best supported model for decision time, the saturated model, is bolded and italicized.