Behavioral Ecology and Sociobiology

SUPPLEMENTARY MATERIAL

INDIVIDUAL RECOGNITION IN GUPPIES DOES NOT REQUIRE LARGE BRAINS.

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Table S1 Outcome of the (generalized) linear models analyzing the spontaneous choice experiment. Significance is indicated as follows: '°' $p < 0.10$, '*', $p < 0.05$, '**', $p < 0.01$, '***' $p < 0.001$ and by bold ($p < 0.05$) or italic text ($p < 0.10$). P-values in the final models for the preference ratios and sampling frequences were adjusted for multiple testing (P_{adj}) using the Benjamini & Hochberg procedure (Benjamini and Hochberg 1995). See main text for more details regarding the response variables and predictors. In case of non-significant interactions, main effects are reported from a model without interaction. Null models without predictors were used to test whether fish overall choose differently from random (intercept = zero). BC-trans = Box Cox transformation. Arcsin = Arcsine transformation.

Response	**N**	**Predictor**	**Estimate ± SE**	**Wald/F-stats**	***P***	***P*$_{adj}$**
Preference Ratio First 5 min *BC-trans* *(λ = 1.5)*	42	Line (small brain) Sex (male) Size difference *Side familiar (right)* **Plant (Familiar side)** Line * Sex	0.045 ± 0.167 -0.083 ± 0.166 -0.729 ± 0.918 -0.364 ± 0.171 0.613 ± 0.169 0.362 ± 0.327	$F_{1,36}$ = 0.071 $F_{1,36}$ = 0.247 $F_{1,36}$ = 0.630 $F_{1,36}$ = 4.556 $F_{1,36}$ = 13.214 $F_{1,35}$ = 1.224	0.792 0.622 0.432 0.040 * < 0.001 *** 0.276	0.792 0.778 0.721 0.099 ° 0.004 **
Preference Ratio *Arcsin-trans*	42	(intercept)	0.158 ± 0.129	$F_{1,41}$ = 1.510	0.226	/
Preference Ratio Last 5 min	44	Line (small brain) Sex (male) Size difference Side familiar (right) Plant (Familiar side) *Replicate* 1 v 2 1 v 3 2 v 3 Line * Sex	0.060 ± 0.157 -0.014 ± 0.155 -1.651 ± 0.871 0.146 ± 0.160 0.181 ± 0.161 0.277 ± 0.193 0.451 ± 0.202 0174 ± 0.185 0.091 ± 0.313	$F_{1,36}$ = 0.147 $F_{1,36}$ = 0.008 $F_{1,36}$ = 3.588 $F_{1,36}$ = 0.838 $F_{1,36}$ = 1.269 $F_{2,36}$ = 2.509 $F_{1,35}$ = 0.084	0.704 0.931 0.066 ° 0.366 0.267 0.095 ° 0.335 0.080 0.619 0.774	0.845 0.931 0.286 0.549 0.535 0.286
Preference Ratio Last 5 min	44	**(intercept)**	0.161 ± 0.078	$F_{1,43}$ = 4.253	0.045 *	/
Preference Ratio 10 min	44	Line (small brain) Sex (male) Size difference Side familiar (right) Plant (Familiar side) Line * Sex	0.052 ± 0.134 -0.024 ± 0.132 -1.084 ± 0.727 -0.090 ± 0.136 0.295 ± 0.135 0.193 ± 0.264	$F_{1,38}$ = 0.155 $F_{1,38}$ = 0.033 $F_{1,38}$ = 2.224 $F_{1,38}$ = 0.436 $F_{1,38}$ = 4.812 $F_{1,37}$ = 0.535	0.696 0.856 0.144 0.513 0.034 * 0.469	0.856 0.856 0.360 0.855 0.172
Preference Ratio 10 min	44	**(intercept)**	0.144 ± 0.069	$F_{1,43}$ = 4.373	0.042 *	/
First choice (1/0)	44	Line (small brain) Sex (male) Size difference Side familiar (right) Plant (Familiar side) *Batch (2)* Line * Sex	0.228 ± 0.701 0.175 ± 0.692 -3.104 ± 4.055 -1.170 ± 0.713 1.022 ± 0.723 -1.218 ± 0.713 0.332 ± 1.373	χ^2 = 0.105, df = 1 χ^2 = 0.064, df = 1 χ^2 = 0.586, df = 1 χ^2 = 2.690, df = 1 χ^2 = 1.997, df = 1 χ^2 = 2.915, df = 1 χ^2 = 0.058, df = 1	0.745 0.800 0.444 0.101 0.158 0.088 ° 0.809	/

Table S1 Continued

Response	**N**	**Predictor**	**Estimate ± SE**	**Wald/F-stats**	***P***	P_{adj}
Sampling First 5 min	42	Line (small brain)	-0.122 ± 0.188	$\chi^2 = 0.422$, df = 1	0.516	0.619
		Sex (male)	0.601 ± 0.194	$\chi^2 = 9.591$, df = 1	0.002 **	0.012 *
		ΔSize Large – Small	2.958 ± 1.521	$\chi^2 = 3.782$, df = 1	0.052 °	0.122
		Side familiar (right)	-0.003 ± 0.188	$\chi^2 = 0.000$, df = 1	0.986	0.986
		Plant (Familiar side)	-0.259 ± 0.187	$\chi^2 = 1.197$, df = 1	0.166	0.249
		Room (2)	-0.341 ± 0.182	$\chi^2 = 3.506$, df = 1	0.061 °	0.122
		Line * Sex	-0.150 ± 0.372	$\chi^2 = 0.162$, df = 1	0.687	
Sampling Last 5 min	42	Line (small brain)	-0.340 ± 0.214	$\chi^2 = 2.535$, df = 1	0.111	0.134
		Sex (male)	0.388 ± 0.218	$\chi^2 = 3.171$, df = 1	0.075 °	0.112
		ΔSize Large – Small	-0.428 ± 1.894	$\chi^2 = 0.051$, df = 1	0.822	0.821
		Side familiar (right)	-0.445 ± 0.212	$\chi^2 = 4.418$, df = 1	0.036 *	0.112
		Plant	-0.388 ± 0.213	$\chi^2 = 3.303$, df = 1	0.069 °	0.112
		Room (2)	-0.364 ± 0.202	$\chi^2 = 3.240$, df = 1	0.072 °	0.112
		Line * Sex	-0.210 ± 0.407	$\chi^2 = 0.267$, df = 1	0.605	
Sampling 10 min	44	Line (small brain)	-0.175 ± 0.198	$\chi^2 = 0.780$, df = 1	0.377	0.450
		Sex (male)	0.508 ± 0.200	$\chi^2 = 6.477$, df = 1	0.011 *	0.044 *
		ΔSize Large – Small	1.223 ± 1.620	$\chi^2 = 0.570$, df = 1	0.450	0.450
		Side familiar (right)	-0.226 ± 0.196	$\chi^2 = 1.330$, df = 1	0.249	0.373
		Plant	-0.346 ± 0.197	$\chi^2 = 3.093$, df = 1	0.078 °	0.157
		Room (2)	-0.466 ± 0.191	$\chi^2 = 5.974$, df = 1	0.015 *	0.044 *
		Line * Sex	-0.096 ± 0.386	$\chi^2 = 0.062$, df = 1	0.804	

Table S2 Outcome of the (generalized) linear models analyzing the trained choice experiment. Significance is indicated as follows: '°' $p < 0.10$, '*', $p < 0.05$, '**', $p < 0.01$, '***' $p < 0.001$ and by bold ($p < 0.05$) or italic text ($p < 0.10$). P-values in the final models for the preference ratios and sampling frequences were adjusted for multiple testing (P_{adj}) using the Benjamini & Hochberg procedure (Benjamini and Hochberg 1995). See main text for more details regarding the response variables and predictors. In case of non-significant interactions, main effects are reported from a model without interaction. Null models without predictors were used to test whether fish overall choose differently from random (intercept = zero). BC-trans = Box Cox transformation. Asin = Arcsine transformation

Response	**N**	**Predictor**	**Estimate ± SE**	**Wald/F-stats**	***P***	***P_{adj}***
Preference Ratio First 5 min	55	Line (small brain)	0.188 ± 0.157	$F_{1,48} = 1.436$	0.237	0.254
		Sex (male)	0.205 ± 0.161	$F_{1,48} = 1.629$	0.208	0.254
		Side familiar (right)	-0.249 ± 0.171	$F_{1,48} = 2.112$	0.153	0.254
		Size difference	0.923 ± 0.799	$F_{1,48} = 1.335$	0.254	0.254
		Plant (rewarded side)	0.271 ± 0.157	$F_{1,48} = 2.992$	0.090 °	0.254
		Batch (2)	-0.381 ± 0.164	$F_{1,48} = 5.365$	0.025 *	0.149
		Line * Sex	-0.348 ± 0.333	$F_{1,47} = 1.089$	0.302	
Preference Ratio First 5 min Arcsin - Trans	55	**(intercept)**	-0.237 ± 0.120	$F_{1,54} = 3.904$	0.053 °	/
Preference Ratio Last 5 min	56	Line (small brain)	0.064 ± 0.174	$F_{1,50} = 0.133$	0.717	0.836
		Sex (male)	-0.037 ± 0.179	$F_{1,50} = 0.043$	0.836	0.836
		Side familiar (right)	-0.069 ± 0.184	$F_{1,50} = 0.142$	0.708	0.836
		Size difference	-0.913 ± 0.888	$F_{1,50} = 1.059$	0.308	0.836
		Plant (rewarded side)	0.042 ± 0.175	$F_{1,50} = 0.057$	0.812	0.836
		Line * Sex	-0.094 ± 0.375	$F_{1,49} = 0.062$	0.804	
Preference Ratio Last 5 min Arcsin - Trans	56	(intercept)	0.013 ± 0.107	$F_{1,55} = 0.014$	0.908	/
Preference Ratio 10 min	56	Line (small brain)	0.125 ± 0.138	$F_{1,49} = 0.815$	0.371	0.556
		Sex (male)	0.088 ± 0.142	$F_{1,49} = 0.382$	0.539	0.647
		Side familiar (right)	-0.166 ± 0.152	$F_{1,49} = 1.198$	0.279	0.556
		Size difference	-0.150 ± 0.709	$F_{1,49} = 0.045$	0.834	0.834
		Batch (2)	-0.261 ± 0.145	$F_{1,49} = 3.229$	0.079 °	0.471
		Plant	0.164 ± 0.138	$F_{1,49} = 1.416$	0.240	0.556
		Line * Sex	-0.243 ± 0.295	$F_{1,48} = 0.680$	0.414	
Preference Ratio 10 min	56	(intercept)	-0.059 ± 0.069	$F_{1,55} = 0.752$	0.390	/

Table S2 Continued

Response	N	Predictor	Estimate ± SE	Wald/F-stats	*P*	P_{adj}
First choice	55	Line (small brain)	0.537 ± 0.590	$\chi^2 = 0.829$, df = 1	0.363	/
		Sex (male)	0.381 ± 0.598	$\chi^2 = 0.407$, df = 1	0.523	
		Side familiar (right)	0.376 ± 0.622	$\chi^2 = 0.365$, df = 1	0.546	
		Size difference	2.877 ± 3.179	$\chi^2 = 0.819$, df = 1	0.365	
		Plant (rewarded side)	1.032 ± 0.595	$\chi^2 = 3.004$, df = 1	0.083 °	
		Line * Sex	-0.969 ± 1.317	$\chi^2 = 0.542$, df = 1	0.462	
Sampling First 5 min Negative binomial	55	Line (small brain)	-0.130 ± 0.210	$\chi^2 = 0.384$, df = 1	0.535	0.815
		Sex (male)	0.441 ± 0.241	$\chi^2 = 3.360$, df = 1	0.067 °	0.334
		Side familiar (right)	-0.095 ± 0.211	$\chi^2 = 0.203$, df = 1	0.652	0.815
		Size difference	0.961 ± 1.717	$\chi^2 = 0.313$, df = 1	0.576	0.815
		Plant (rewarded side)	-0.035 ± 0.210	$\chi^2 = 0.029$, df = 1	0.866	0.866
		Line * Sex	0.597 ± 0.419	$\chi^2 = 2.032$, df = 1	0.154	
Sampling Last 5 min Negative binomial	52	Line (small brain)	-0.242 ± 0.220	$\chi^2 = 1.210$, df = 1	0.271	0.828
		Sex (male)	0.158 ± 0.258	$\chi^2 = 0.373$, df = 1	0.542	0.828
		Side familiar (right)	0.072 ± 0.222	$\chi^2 = 0.105$, df = 1	0.746	0.828
		Size difference	1.739 ± 1.842	$\chi^2 = 0.891$, df = 1	0.345	0.828
		Plant (rewarded side)	0.048 ± 0.222	$\chi^2 = 0.047$, df = 1	0.828	0.828
		*Line * Sex*	0.746 ± 0.432	$\chi^2 = 2.975$, df = 1	0.085 °	
		<u>Post-hoc comparisons</u>				
		F_{LARGE} vs M_{LARGE}	1.214 ± 0.384		0.928	
		F_{LARGE} vs F_{SMALL}	1.878 ± 0.575		0.167	
		F_{LARGE} vs M_{SMALL}	1.082 ± 0.370		0.996	
		M_{LARGE} vs F_{SMALL}	1.547 ± 0.497		0.526	
		F_{SMALL} vs M_{SMALL}	0.576 ± 0.201		0.389	
		M_{LARGE} vs M_{SMALL}	0.891 ± 0.270		0.982	
Sampling 10 min Negative binomial	56	Line (small brain)	-0.296 ± 0.217	$\chi^2 = 1.858$, df = 1	0.173	0.432
		Sex (male)	0.422 ± 0.251	$\chi^2 = 2.834$, df = 1	0.092 °	0.432
		Side familiar (right)	0.011 ± 0.219	$\chi^2 = 0.003$, df = 1	0.959	0.959
		Size difference	1.493 ± 1.783	$\chi^2 = 0.702$, df = 1	0.402	0.670
		Plant (rewarded side)	0.118 ± 0.218	$\chi^2 = 0.295$, df = 1	0.587	0.734
		Line * Sex	0.692 ± 0.433	$\chi^2 = 2.549$, df = 1	0.110	

References

Benjamini Y, Hochberg Y (1995) Controlling the false discovery rate: a practical and powerful approach to multiple testing. J R Stat Soc Ser B Methodol 57: 289-300.