

DIVING BACK TWO HUNDRED MILLION YEARS: YAWN CONTAGION IN FISH

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Supplementary Table 1 - Data on the duration of the three yawning different phases

Yawner ID	Condition	Duration (<i>sec</i>)			
		Phase 1	Phase 2	Phase 3	Total
1	Experimental	00.360	00.090	00.250	00.700
1	Experimental	00.300	00.120	00.090	00.510
1	Experimental	00.320	00.080	00.240	00.640
1	Control	00.211	00.170	00.001	00.382
2	Experimental	00.433	00.030	00.380	00.843
2	Experimental	00.205	00.078	00.000	00.283
2	Experimental	00.261	00.197	00.126	00.584
2	Experimental	00.124	00.040	00.040	00.204
2	Experimental	00.248	00.060	00.000	00.308
2	Experimental	00.283	00.039	00.079	00.401
4	Experimental	00.396	00.170	00.063	00.629
4	Experimental	00.538	00.122	00.143	00.803
4	Experimental	00.448	00.184	00.055	00.687
4	Experimental	00.377	00.123	00.072	00.572
4	Experimental	00.912	00.015	00.129	01.056
5	Experimental	00.084	00.047	00.010	00.141
5	Experimental	00.055	00.052	00.043	00.150
5	Experimental	00.123	00.055	00.012	00.190
5	Experimental	00.090	00.057	00.073	00.220
5	Control	00.187	00.138	00.048	00.373
5	Control	00.102	00.031	00.022	00.155
6	Control	00.450	00.205	00.062	00.799
6	Experimental	00.414	00.088	00.098	00.600
6	Experimental	00.437	00.128	00.153	00.718
6	Experimental	00.413	00.222	00.085	00.720
7	Experimental	00.158	00.047	00.065	00.270
7	Control	00.404	00.134	00.098	00.636
7	Control	00.487	00.047	00.080	00.614
8	Experimental	00.315	00.085	00.047	00.447
8	Experimental	00.449	00.236	00.234	00.919
9	Control	00.343	00.188	00.194	00.725
9	Control	00.376	00.209	00.175	00.760
9	Control	00.335	00.187	00.153	00.675
9	Experimental	00.570	00.087	00.123	00.780
9	Experimental	00.324	00.088	00.047	00.459
9	Experimental	00.084	00.165	00.316	00.565
9	Experimental	00.280	00.138	00.228	00.646
10	Experimental	00.268	00.049	00.251	00.568
10	Experimental	00.595	00.072	00.161	00.828
10	Experimental	00.336	00.071	00.281	00.688
10	Experimental	00.148	00.214	00.217	00.579

10	Experimental	00.624	00.184	00.238	01.046
10	Control	00.115	00.051	00.145	00.311
11	Experimental	00.351	00.058	00.166	00.575
11	Experimental	00.543	00.056	00.207	00.806
11	Experimental	00.485	00.077	00.202	00.764
12	Control	00.534	00.074	00.050	00.658
12	Control	00.336	00.190	00.196	00.722
12	Control	00.551	00.056	00.102	00.709
12	Control	00.352	00.140	00.156	00.648
12	Experimental	00.339	00.039	00.235	00.613
12	Experimental	00.523	00.082	00.272	00.877
13	Experimental	00.117	00.091	00.094	00.302
14	Experimental	00.236	00.188	00.359	00.783
14	Experimental	00.406	00.226	00.186	00.818
14	Experimental	00.367	00.145	00.250	00.762
15	Control	00.378	00.167	00.132	00.677
15	Experimental	00.385	00.216	00.246	00.847
15	Experimental	00.443	00.157	00.216	00.816
15	Experimental	00.142	00.125	00.019	00.286
16	Control	00.398	00.000	00.154	00.552
16	Control	00.428	00.000	00.018	00.446
16	Control	00.169	00.249	00.104	00.522
16	Control	00.457	00.023	00.180	00.660
16	Control	00.372	00.123	00.186	00.681
16	Control	00.566	00.035	00.083	00.684
16	Control	00.278	00.144	00.163	00.585
16	Control	00.297	00.211	00.137	00.645
16	Experimental	00.421	00.023	00.007	00.451
16	Experimental	00.267	00.098	00.101	00.466
16	Experimental	00.382	00.078	00.107	00.567
17	Experimental	00.431	00.035	00.086	00.552
17	Experimental	00.370	00.090	00.167	00.627
17	Experimental	00.448	00.093	00.195	00.736
17	Experimental	00.397	00.036	00.108	00.541
18	Experimental	00.038	00.087	00.048	00.173
18	Experimental	00.277	00.150	00.056	00.483
18	Control	00.294	00.044	00.090	00.428
18	Control	00.383	00.116	00.083	00.582
18	Control	00.211	00.077	00.072	00.360
19	Control	00.385	00.118	00.132	00.635
19	Control	00.480	00.236	00.100	00.816
19	Experimental	00.286	00.334	00.082	00.702
19	Experimental	00.160	00.118	00.096	00.374
20	Experimental	00.272	00.055	00.099	00.426
20	Experimental	00.326	00.223	00.168	00.717
20	Experimental	00.160	00.312	00.261	00.733
21	Experimental	00.174	00.044	00.103	00.321
21	Experimental	00.314	00.048	00.071	00.433
21	Experimental	00.270	00.146	00.170	00.586
21	Control	00.295	00.220	00.199	00.714
21	Control	00.329	00.101	00.237	00.667

21	Control	00.159	00.139	00.184	00.482
22	Experimental	00.319	00.167	00.172	00.658
22	Experimental	00.418	00.019	00.319	00.756
22	Experimental	00.560	00.035	00.676	00.871
22	Experimental	00.303	00.112	00.127	00.542
22	Experimental	00.442	00.182	00.133	00.757
22	Experimental	00.279	00.130	00.218	00.627
22	Experimental	00.634	00.022	00.122	00.778

Phase 1) mouth opening slowly and widely, reaching the maximum mouth size, Phase 2) mouth gaping typically accompanied by the expansion of the gill covers and by a noticeable stretching of the jaw, Phase 3) rapid mouth closing). Yawner ID = identity of the subject emitting the yawn. Condition = condition in which the yawn was performed (Experimental: Yawning_{video}; Control: Breathing_{video}).

Supplementary Table 2 – Statistical results of *MODEL_{duration}* and *MODEL_{stretching}*

Yawning and breathing differ in their duration (<i>MODEL_{duration}</i>)					
Fixed Effects	Coeff	SE	χ^2	df	P
Intercept	0.149	0.013	n/a	n/a	n/a
TESTED VARIABLE					
Y/B	0.270	0.016	285.86	1	<0.01
Variance for the random factors: ID _{tester} = 0.0002465±0.0157SD; N _{observation} = 272; N _{tester} = 18					
Yawning with and without stretching differs in their duration (<i>MODEL_{stretching}</i>)					
Fixed Effects	Coeff	SE	χ^2	df	P
Intercept	0.328	0.019	n/a	n/a	n/a
TESTED VARIABLE					
STRETCHING	0.160	0.025	38.959	1	<0.001
Variance for the random factors: ID _{tester} = 7.267e ⁻¹² ±2.696e ⁻⁰⁶ ; N _{observation} = 136; N _{tester} = 18					

Estimated parameters (Coeff), Standard Error (SE), and results of the Likelihood Ratio Tests (χ^2) of the *MODEL_{duration}* and *MODEL_{stretching}*. Significant *P* values are shown in bold; df= degree of freedom; n/a = not applicable

Supplementary Table 3 - Statistical results of *MODEL_{contagion}*

Contagious yawning (<i>MODEL_{contagion}</i>)					
Fixed Effects	Coeff	SE	χ^2	df	P
Intercept	0.680	0.317	n/a	n/a	n/a
TESTED VARIABLE					
CONDITION	0.696	0.225	9.561	1	0.002
SEX	-0.041	0.226	0.033	1	0.855
CONTROL VARIABLES					
ORDER OF TREATMENT	-0.226	0.250	0.819	1	0.365
DAYTIME	-0.184	0.219	0.703	1	0.401
Variance for the random factors: ID _{tester} = 0.0122±0.110SD; N _{observation} = 44; N _{tester} = 22					

Estimated parameters (Coeff), Standard Error (SE), and results of the Likelihood Ratio Tests (χ^2) of the *MODEL_{contagion}*. Significant *P* values are shown in bold; df= degree of freedom; n/a = not applicable.

Supplementary Table 4 – Statistical results of *MODEL_{latency_first}* and *MODEL_{latency_all}*

Latency of the first yawn is shorter under Yawning _{video} (<i>MODEL_{latency_first}</i>)					
Fixed Effects	Coeff	SE	χ^2	df	P
Intercept	5.624	0.253	n/a	n/a	n/a
TESTED VARIABLE					
CONDITION	-0.085	0.025	11.087	1	<0.001
CONTROLLED VARIABLES					
ORDER OF TREATMENT	0.344	0.270	1.623	1	0.202
SEX	-0.517	0.270	3.665	1	0.055
DAY TIME	-0.044	0.025	3.030	1	0.081
Variance for the random factors: ID _{tester} = 0.37±0.6083SD; N _{observation} = 33; N _{tester} = 21					
Latencies of the yawn responses are shorter under Yawning _{video} (<i>MODEL_{latency_all}</i>)					
Fixed Effects	Coeff	SE	χ^2	df	P
Intercept	6.262	0.093	n/a	n/a	n/a
TESTED VARIABLE					
CONDITION	-0.112	0.013	71.129	1	<0.001
CONTROLLED VARIABLES					
ORDER OF TREATMENT	0.098	0.100	0.978	1	0.322
SEX	-0.235	0.099	5.544	1	0.018
DAY TIME	0.072	0.013	29.508	1	<0.001
Variance for the random factors: ID _{tester} = 0.05052±0.2248; N _{observation} = 98; N _{tester} = 21					

Estimated parameters (Coeff), Standard Error (SE), and results of the Likelihood Ratio Tests (χ^2) of the *MODEL_{latency_first}* and *MODEL_{latency_all}*. Significant *P* values are shown in bold; df= degree of freedom; n/a = not applicable.

Supplementary Table 5 – Statistical results of *MODEL_{change}*

Behavioral state changes are more probable after a yawning with stretching (<i>MODEL_{change}</i>)					
Fixed Effects	Coeff	SE	χ^2	df	P
Intercept	-3.957	1.443	n/a	n/a	n/a
TESTED VARIABLE					
STRETCHING	4.203	1.401	9.002	1	0.002
CONTROL VARIABLES					
CONDITION	-0.942	1.243	0.573	1	0.449
Variance for the random factors: ID _{tester} = 3.7585±1.9387SD; ID _{tester} = 0.5179±0.7197SD; N _{observation} = 100; N _{tester} = 21; Number _{trial} =33.					

Estimated parameters (Coeff), Standard Error (SE), and results of the Likelihood Ratio Tests (χ^2) of the *MODEL_{change}*. Significant *P* values are shown in bold; df= degree of freedom; n/a = not applicable.

Supplementary Figure 1 - 12 sample predictions from the test dataset, organized by class:
yawning event (Y, light green), breathing event (B, light blue), and mouth closed (MC, orange).

