Does social environment influence learning ability in a family-living lizard?
Animal Cognition
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Supplementary Materials

Behavioural scoring agreement

JLR initially scored task success for the first stage of the task and the full task, latency to complete the task, and number of errors during each trial in May 2016. After 7 months had passed, JLR re-scored the same behaviours for a random selection of 10% of our videos (N = 86), while being blind to the original scores, to assess agreement. We assessed score agreement using Cohen's Kappa (using the function *cohen.kappa* from the R package *psych* in R v 3.0.3; Kaufman and Rosenthal 2009; R Core Team 2016). Cohen's Kappa agreement scores are considered "excellent" when $k \geq 0.75$ (Kaufman and Rosenthal 2009). Scores of task success for the first stage of the task and the full task agreed 100% of the time ($k = 1$ for both the first stage and the full task). Score agreements for both latency ($k = 1$, *95% CI* = 0.99-1) and number of errors ($k = 0.99$, *95% CI* = 0.98-1) were also high. Our assessment suggests that our behavioural scoring was accurate to quantify tree skink behaviours.

References

Kaufman AB, Rosenthal R (2009) Can you believe my eyes? The importance of interobserver reliability statistics in observations of animal behaviour. Anim Behav 78:1487-1491. doi: 10.1016/j.anbehav.2009.09.014

R Core Team (2016) A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria, URL https://www.R-project.org/.

VIDEOS

Supplementary Video 1. Correct demonstration of our spatial learning task for *Egernia striolata*.

TABLES

Table S1. Tally of correct (1) and incorrect (0) choices for the first stage (3 ladder choice) of the spatial learning task. The learning criterion (5/6 correct choices) is outlined for each lizard. The trial at which each lizard 'learnt' the task is bolded and italicized. The trials that we used to assess robustness of our learning criterion are shaded in grey. Lizard treatment (I = isolated, S = social), number of trials taken to learn the task, each lizard's learning categorization (learner = Y, non-learner = N), tally of correct/incorrect trials for the assessment of the learning criterion, and binomial probability of each assessment of the learning criterion are also specified.

Lizard	Treatment	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	Number of trials to learn	Learning	Tally of correct choices	Binomial probability
B0053	I	1	0	0	1	0	0	1	0	1	1	0	0	1	0	1	0	1	1	0	1	1	0	1	1	***1***	1	0	0	0	1	25	Y	3/6	0.22
B0025	I	0	0	0	1	1	1	1	1	***1***	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	Y	21/22	<0.001
B0002	S	1	0	0	0	1	0	1	0	0	0	1	0	0	1	1	1	0	0	1	1	0	1	1	***1***	0	0	1	1	1	1	24	Y	5/7	0.04
B0130	S	0	1	0	0	1	1	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	1	1	1	1	1	***1***	1	29	Y		
B0010	S	0	0	0	0	0	0	0	1	1	1	0	0	1	1	0	1	1	0	1	1	0	0	1	1	0	1	1	***1***	1	1	28	Y		
B0102	S	0	1	1	0	0	0	0	0	1	1	1	1	0	***1***	1	1	0	1	0	0	1	1	0	1	1	1	1	0	1	1	14	Y	12/17	0.002
B0120	I	0	1	1	0	1	0	0	1	1	1	1	1	***1***	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	13	Y	17/18	<0.001
B0020	S	0	0	0	0	1	1	1	1	1	***1***	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10	Y	21/21	<0.001
B0123	S	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	***1***	1	1	1	1	0	1	1	1	1	1	1	0	1	1	16	Y	13/15	<0.001
B0133	I	0	0	0	0	0	0	0	1	1	0	1	1	0	1	1	***1***	0	1	1	1	1	0	1	1	1	1	1	1	0	1	16	Y	12/15	<0.001
B0201	S	0	1	1	1	1	0	***1***	1	0	1	1	0	1	1	1	0	1	1	0	1	1	0	1	0	1	1	1	1	1	1	7	Y	18/24	<0.001
B0152	S	0	0	0	0	0	0	1	1	0	1	1	0	0	1	0	0	1	1	0	1	0	1	0	0	0	1	1	1	0	0		N		
B0033	I	0	0	1	1	0	1	1	***1***	0	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	8	Y	19/23	<0.001
B0050	I	0	0	1	1	1	1	1	***1***	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	8	Y	22/23	<0.001
B0115	S	0	1	1	1	0	0	1	1	1	1	1	***1***	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	12	Y	18/19	0.001
B0205	S	0	0	0	0	1	1	0	0	0	1	1	1	0	1	***1***	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	15	Y	10/16	0.01
B0112	I	0	0	0	0	0	1	0	1	1	1	0	1	***1***	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	1	13	Y	15/18	<0.001
B0202	I	0	0	1	0	0	0	0	0	1	1	1	0	0	1	1	1	1	1	***1***	1	1	0	0	1	1	1	1	1	0	1	19	Y	9/12	0.003
B0125	I	1	1	1	0	0	1	1	1	1	1	***1***	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	11	Y	20/20	<0.001
B0003	I	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	NA	NA	NA	NA	NA		N		
B0150	I	0	1	0	0	1	1	1	1	1	***1***	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	10	Y	20/21	<0.001
B0111	I	1	0	1	1	1	***1***	1	1	1	0	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	6	Y	21/25	<0.001
B0113	I	0	1	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	1	1	1	1	***0***	0	1	1	0	1	0	0	23	Y	3/8	0.27
B0210	I	1	0	0	0	1	0	0	0	0	1	1	1	0	0	1	1	1	1	1	***0***	1	1	1	1	0	1	1	1	1	1	20	Y	9/11	0.001
B0151	S	1	0	1	1	1	***1***	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	6	Y	24/25	<0.001
B0131	S	1	1	1	1	1	***1***	0	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	6	Y	22/25	<0.001
B0122	S	0	0	0	1	1	1	1	0	***1***	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	9	Y	19/22	<0.001
B0001	S	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	0	1		N		

Table S2. Tally of correct (1) and incorrect (0) choices for the full spatial learning task (3 ladder choice followed by a 2 ladder choice). The learning criterion (5/6 correct choices) is outlined for each lizard. The trial at which each lizard 'learnt' the task is bolded and italicized. The trials that we used to assess robustness of our learning criterion are shaded in grey. Lizard treatment (I = isolated, S = social), number of trials taken to learn the task, each lizard's learning categorization (learner = Y, non-learner = N), tally of correct/incorrect trials for the assessment of the learning criterion, and binomial probability of each assessment of learning criterion are also specified.

Lizard	Treatment	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	T25	T26	T27	T28	T29	T30	Number of trials to learn	Learning	Tally of correct choices	Binomial probability
B0053	I	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	***1***	1	0	0	0	1	1	1	1	0	1	1	19	Y	8/12	<0.001
B0025	I	0	0	0	1	0	1	1	1	***1***	0	0	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	9	Y	17/22	<0.001
B0002	S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	1	0	1	1	0	0		N		
B0130	S	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	***1***	0	29	Y		
B0010	S	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0		N		
B0102	S	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	1	0	1	1	1	1	0	***1***	1	1	28	Y		
B0120	I	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	***1***	1	1	1	0	1	0	1	1	0	1	20	Y	8/11	<0.001
B0020	S	0	0	0	0	1	1	1	1	1	***1***	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	10	Y	21/21	<0.001
B0123	S	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	***1***	1	1	1	0	0	1	1	1	1	1	1	0	1	1	16	Y	12/15	<0.001
B0133	I	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	0	1	***1***	1	1	0	1	1	1	1	1	0	1	0	19	Y	9/12	<0.001
B0201	S	0	1	0	1	0	0	1	0	1	1	1	0	1	1	0	1	1	0	1	0	1	1	0	1	0	1	0	1	0	1		N		
B0152	S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1		N		
B0033	I	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	1	***1***	0	0	0	1	0	0	1	0	1	0	20	Y	4/11	0.07
B0050	I	0	0	1	0	0	0	0	1	1	1	1	0	***1***	0	1	0	1	1	1	0	0	0	1	1	1	1	0	1	1	0	13	Y	11/18	<0.001
B0115	S	0	1	1	0	0	0	1	1	1	1	1	***0***	1	0	1	1	1	1	1	0	1	0	0	1	1	0	1	0	1	1	12	Y	12/19	<0.001
B0205	S	0	0	0	0	0	0	0	0	1	1	1	0	1	***1***	0	0	0	0	0	0	1	1	0	1	1	1	NA	NA	NA	NA	14	Y	6/13	0.01
B0112	I	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	0	1	1	***1***	1	1	1	1	1	0	0	1	0	NA	NA	19	Y	7/10	<0.001
B0202	I	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0	0	1	0	1	1	1	0	1	0		N		
B0125	I	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0		N		
B0003	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	NA	NA	NA	NA	NA		N		
B0150	I	0	1	0	0	1	1	1	1	0	***1***	0	0	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	10	Y	17/21	<0.001
B0111	I	0	0	0	0	1	0	0	1	0	0	0	1	1	1	1	1	***0***	0	0	0	1	1	0	0	0	1	0	1	1	1	17	Y	6/14	0.01
B0113	I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	1	0	0	1	NA	NA		N		
B0210	I	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	***1***	1	1	1	0	1	1	0	1	1	1	0	19	Y	9/12	<0.001
B0151	S	1	0	0	0	0	0	0	1	1	1	1	1	***1***	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	13	Y	15/18	<0.001
B0131	S	0	0	0	0	1	0	0	1	0	1	1	1	***1***	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	13	Y	17/18	<0.001
B0122	S	0	0	0	1	1	1	1	0	***1***	1	1	1	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	0	9	Y	19/22	<0.001
B0053	I	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	1	***1***	1	0	0	0	1	1	1	1	0	1	1	19	Y	8/12	<0.001

FIGURES

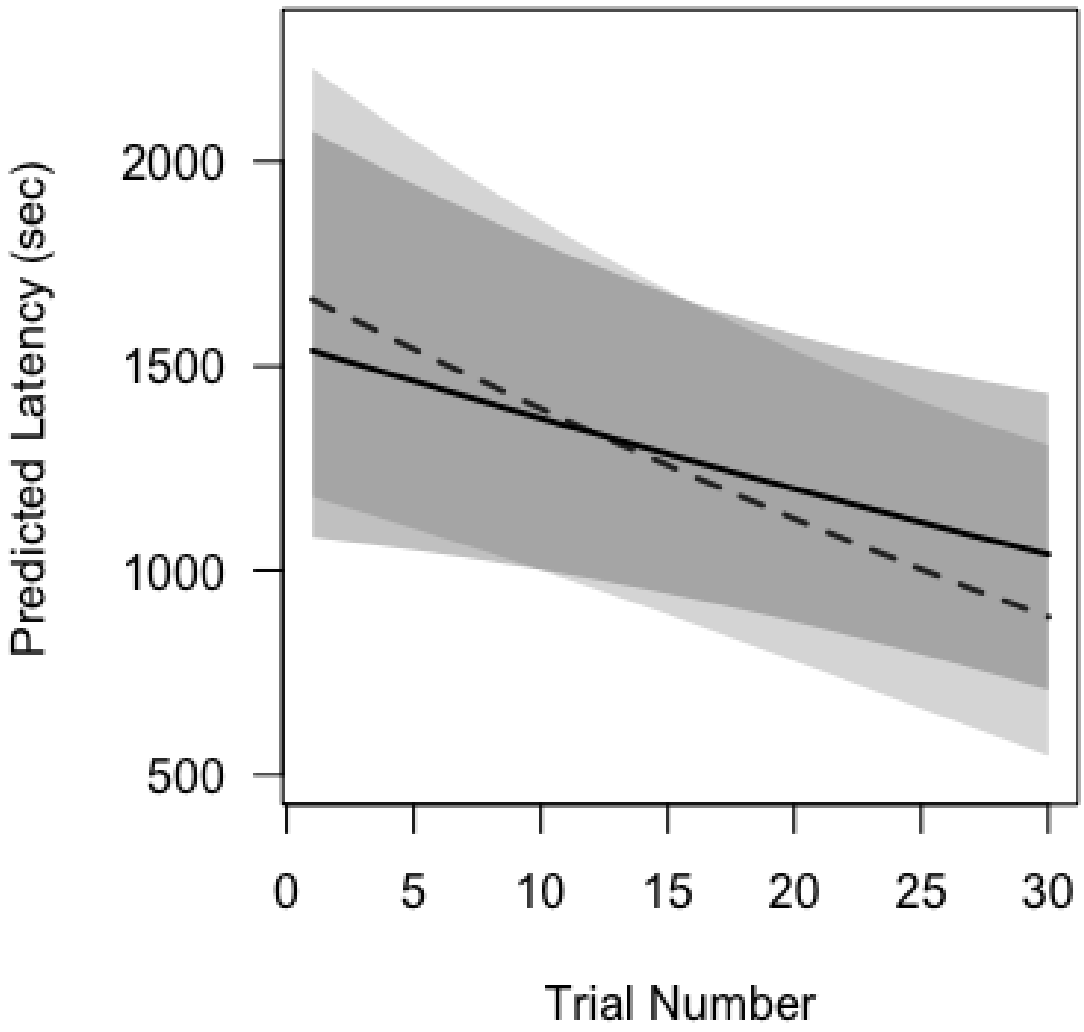

Fig. S1 Predicted latency until successful completion of the task (s) during each trial did not differ between rearing treatments (social: light grey shading and dashed line; isolated: dark grey shading and solid line) for the full spatial learning task. Latency did decrease over time, which indicates tree skinks were learning the task. The darkest shade of grey is where the 95% predicted credible intervals, which are represented by shaded polygons around predicted latencies, overlap.

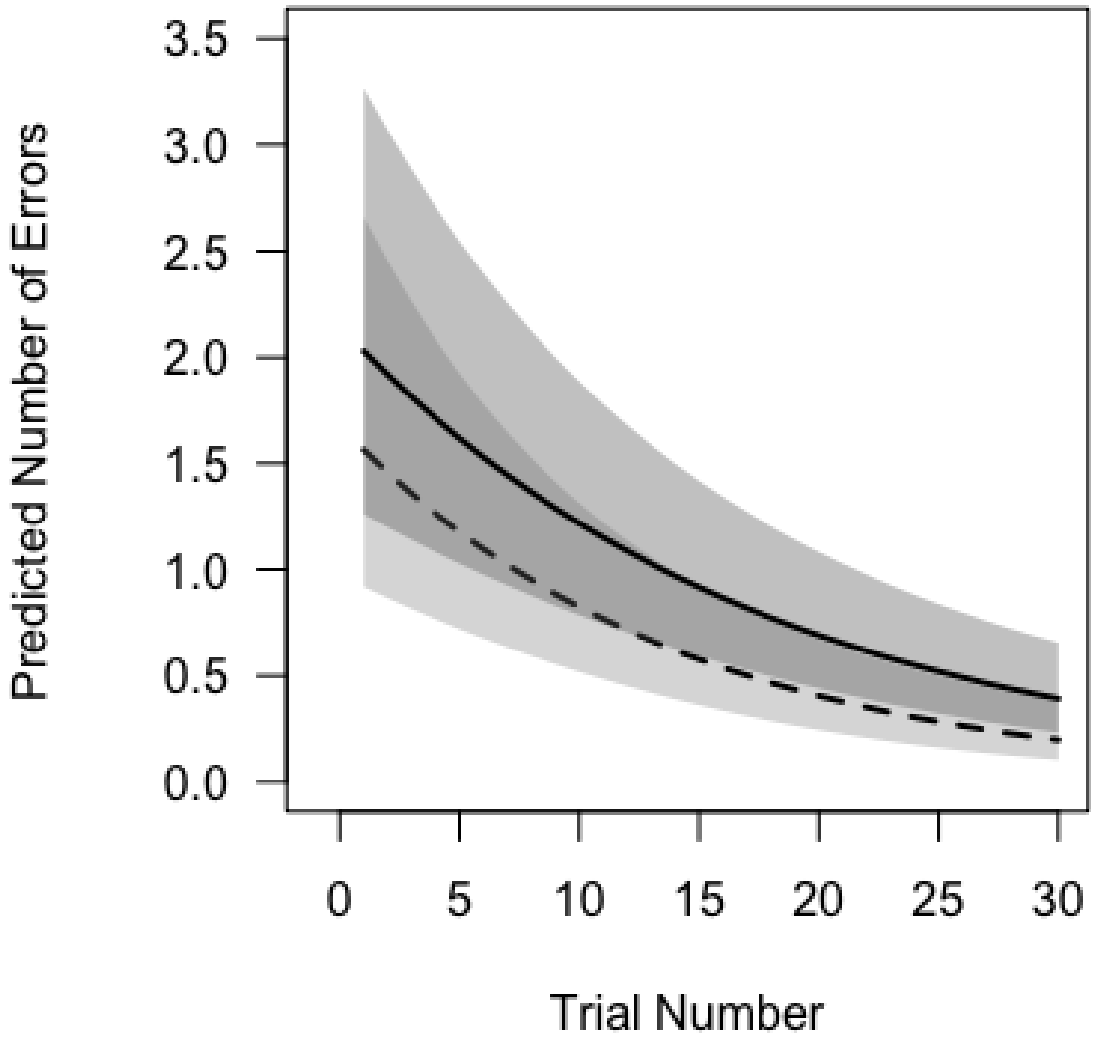

Fig. S2 Predicted number of errors during each trial did not differ between rearing treatments (social: light grey shading and dashed line; isolated: dark grey shading and solid line) for the full spatial learning task. The number of errors did decrease over time, which indicates skinks were learning the task. The darkest shade of grey is where the 95% predicted credible intervals, which are represented by shaded polygons around predicted number of errors, overlap.