

Supplemental Material

The evolutionary origins of natural pedagogy: rhesus monkeys show sustained attention following nonsocial cues versus social communicative signals

Supplemental results: Looking times across habituation and test trials

In the analysis detailed in the main manuscript, we examined monkeys' total duration of looking to the habituation and test trials across conditions. Table S1 reports the parameters from the full model.

<i>Predictor</i>	<i>Estimate</i>	<i>S.E.</i>	<i>t</i>	<i>p-value</i>
Sex (reference: <i>female</i>)	0.475	0.282	1.685	> 0.093
Cohort (reference: <i>juvenile</i>)	-2.070	0.281	-7.375	< 0.001
Trial (reference: <i>habituation trial</i>)	1.809	0.418	4.324	< 0.001
Cue (reference: <i>nonsocial cue</i>)	1.338	0.493	2.716	= 0.007
Test trial outcome (reference: <i>look away outcome</i>)	1.013	0.495	2.047	= 0.041
Trial x Cue	-1.835	0.592	-3.101	= 0.002
Trial x Test trial outcome	-0.649	0.595	-1.091	> 0.276
Cue x Test trial outcome	-1.741	0.701	-2.485	= 0.013
Trial x Cue x Test trial outcome	1.553	0.841	1.847	> 0.066

Table S1: Predictors of monkey's looking time response. Parameters from the full model examining duration of looking. All models included subject identity as a random effect, as well as sex, age cohort, and trial type (habituation versus test). *Cue type* (social or nonsocial), *test trial outcome* (look to object versus look away) and their interactions with trial type were then added to subsequent models test their significance. Baseline reference for predictors indicated in table.

Supplemental results: Looking times to test trials

As referenced in the main manuscript, we also ran an additional analysis examining the test trial looking time specifically, while using habituation looking time as a predictor. We used linear models. The base model accounted for sex, age cohort and habituation looking time. In the second model, we added *cue type* (social or nonsocial) to assess whether monkeys attended differentially to test events following different kinds of cues. This improved model fit [LRT: $\chi^2 = 4.73$, $df = 1$, $p = 0.03$; see Table S2 for model parameters]. In the third model, we additionally included *test trial outcome* (look to object or look away), to test whether monkeys attended differentially to referential versus non-referential looks. This did not improve model fit [LRT: $\chi^2 = 0.57$, $df = 1$, $p = 0.45$, n.s.]. In the final model we included a three-way interaction between cohort, *cue type*, and *test trial outcome*, which did not improve model fit [LRT: $\chi^2 = 2.72$, $df = 5$, $p = 0.74$, n.s.]. Table S2 contains the parameter estimates from the best-fit model (model 2)

<i>Predictor</i>	<i>Estimate</i>	<i>S.E.</i>	<i>t</i>	<i>p-value</i>
Habituation Looking Time	0.269	0.065	4.126	< 0.001
Sex (reference: <i>female</i>)	0.549	0.335	1.639	> 0.102
Cohort (reference: <i>juvenile</i>)	-1.123	0.365	-3.073	= 0.002
Cue (reference: <i>nonsocial cue</i>)	-0.720	0.333	-2.160	= 0.032

Table S2: Predictors of monkey's test trial looking time response. Parameters from best-fit model examining duration of looking specifically in test trial. All models included habituation looking time, age cohort, and sex; additional predictors were then added to test their significance. Baseline reference for predictors indicated in table.

Supplemental results: Looking time difference score analysis

In an analysis detailed in the main manuscript, we examined monkey’s looking time difference score (Test trial looking – Habituation looking). This difference score indexes relative looking across the habituation and test trials, and allowed us to examine age-related changes in looking patterns. Table S3 contains the parameters from the full model.

<i>Predictor</i>	<i>Estimate</i>	<i>S.E.</i>	<i>t</i>	<i>p-value</i>
Sex (reference: <i>female</i>)	0.297	0.425	0.698	> 0.485
Cohort (reference: <i>juvenile</i>)	0.400	0.840	0.476	> 0.634
Cue (reference: <i>nonsocial</i>)	-1.693	0.831	-2.038	= 0.043
Test trial outcome (reference: <i>look away outcome</i>)	-0.752	0.831	-0.905	> 0.366
Cohort x Cue	-0.339	1.187	-0.286	> 0.775
Cohort x Test trial outcome	0.181	1.192	0.152	> 0.879
Cue x Test trial outcome	1.032	1.170	0.882	> 0.378
Cohort x Cue x Test trial outcome	1.310	1.689	0.775	> 0.439

Table S3: Predictors of monkey’s difference score (age cohorts). All models included cohort and sex. *Cue type* (social or nonsocial), *test trial outcome* (look to object versus look away) and interactions between these variables and cohort were then added to subsequent models to test their significance. Baseline reference for predictors indicated in table.

Supplemental results: Looking time difference score with age as a continuous variable

We also conducted additional analyses examining whether monkeys’ responses to social communicative cues vary over their lifespan, using age in years as a continuous variable to confirm that our use of specific juvenile and adult age cohorts did not impact our results that age did not include looking patterns. We again used linear models to examine different scores, as in the prior analysis. The base model accounted for sex and age, and the second model additionally included *cue type* (social or nonsocial) as a predictor, which improved model fit [LRT: $\chi^2 = 6.55$, $df = 1$, $p = 0.01$: see Table S4 for parameters]. We then added *test trial outcome* (look to object or look away) as a predictor in the third model, which did not improve fit compared to the second model [LRT: $\chi^2 = 0.10$, $df = 1$, $p = 0.75$, n.s.]. In the full model, we included a three-way interaction between age, *cue type* and *test trial outcome*, which did not improve model fit [LRT: $\chi^2 = 5.22$, $df = 5$, $p = 0.39$, n.s.]. Table S4 contains the parameters from the best-fit model (model 2).

<i>Predictor</i>	<i>Estimate</i>	<i>S.E.</i>	<i>t</i>	<i>p-value</i>
Sex (reference: <i>female</i>)	0.323	0.426	0.759	> 0.449
Age in years	0.048	0.052	0.937	> 0.349
Cue (reference: <i>nonsocial</i>)	-1.080	0.423	-2.555	= 0.011

Table S4: Predictors of monkey’s looking time difference score (age as a continuous predictor). Parameters from model examining looking time difference score. All models included sex and age; additional predictors were then added to test their significance. Baseline reference for predictors indicated in table.