Title

The role of egg-nest contrast in the rejection of brood parasitic eggs

Authors

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SUPPLEMENTARY MATERIALS

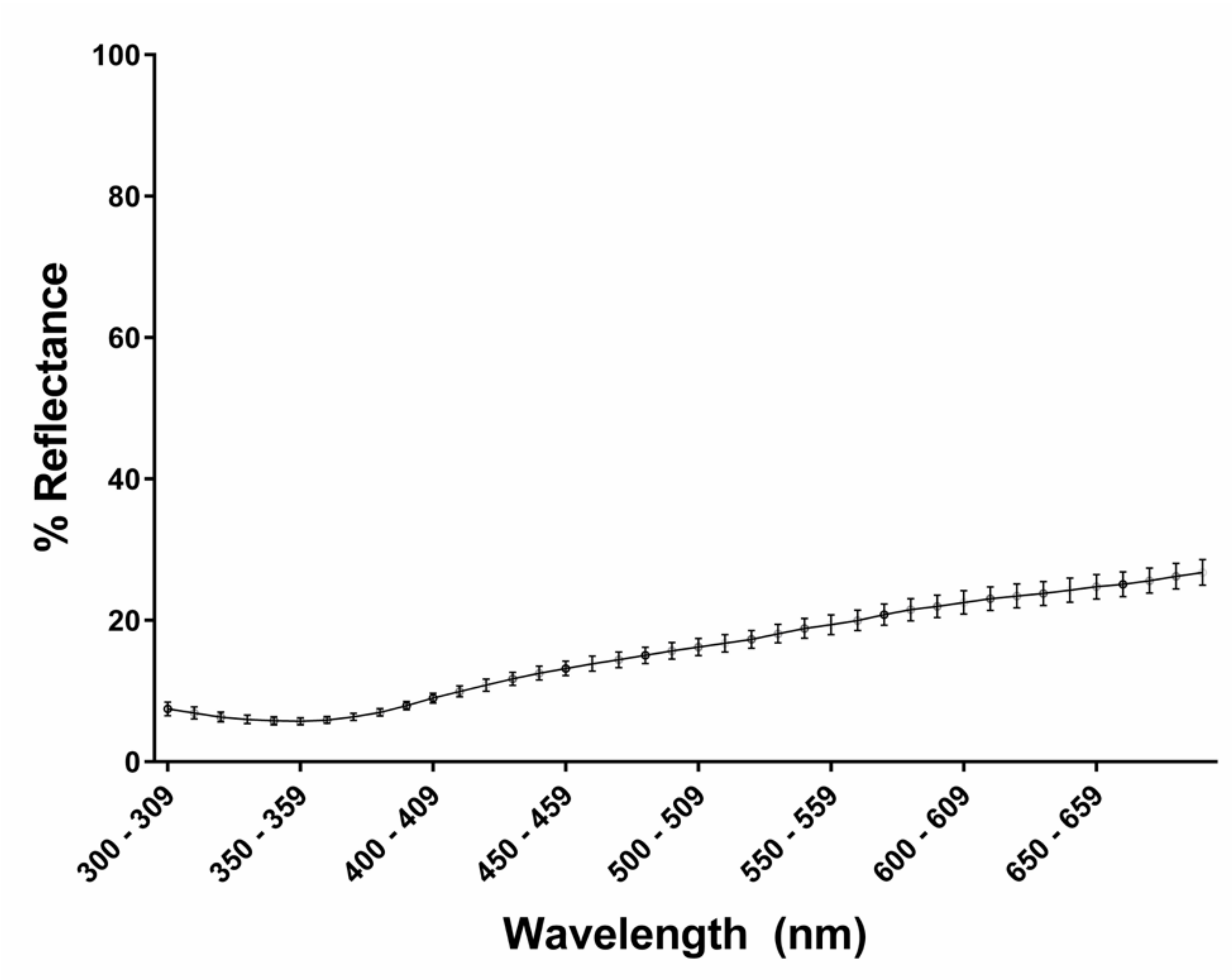

Fig. S1. Mean (S.E.M.) reflectance spectra across the avian visible spectrum of all natural nests. Data are batched over 10 nm intervals.

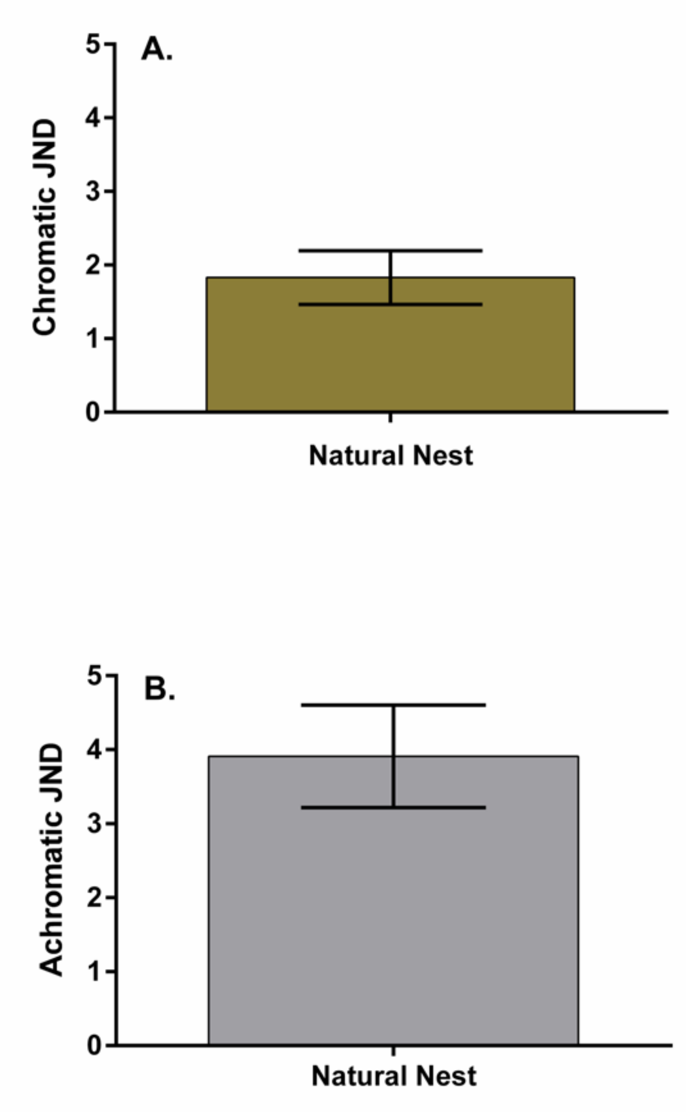

Fig. S2. Mean (S.E.M.) chromatic (A) and achromatic (B) JNDs between randomly-paired natural robin nest linings.

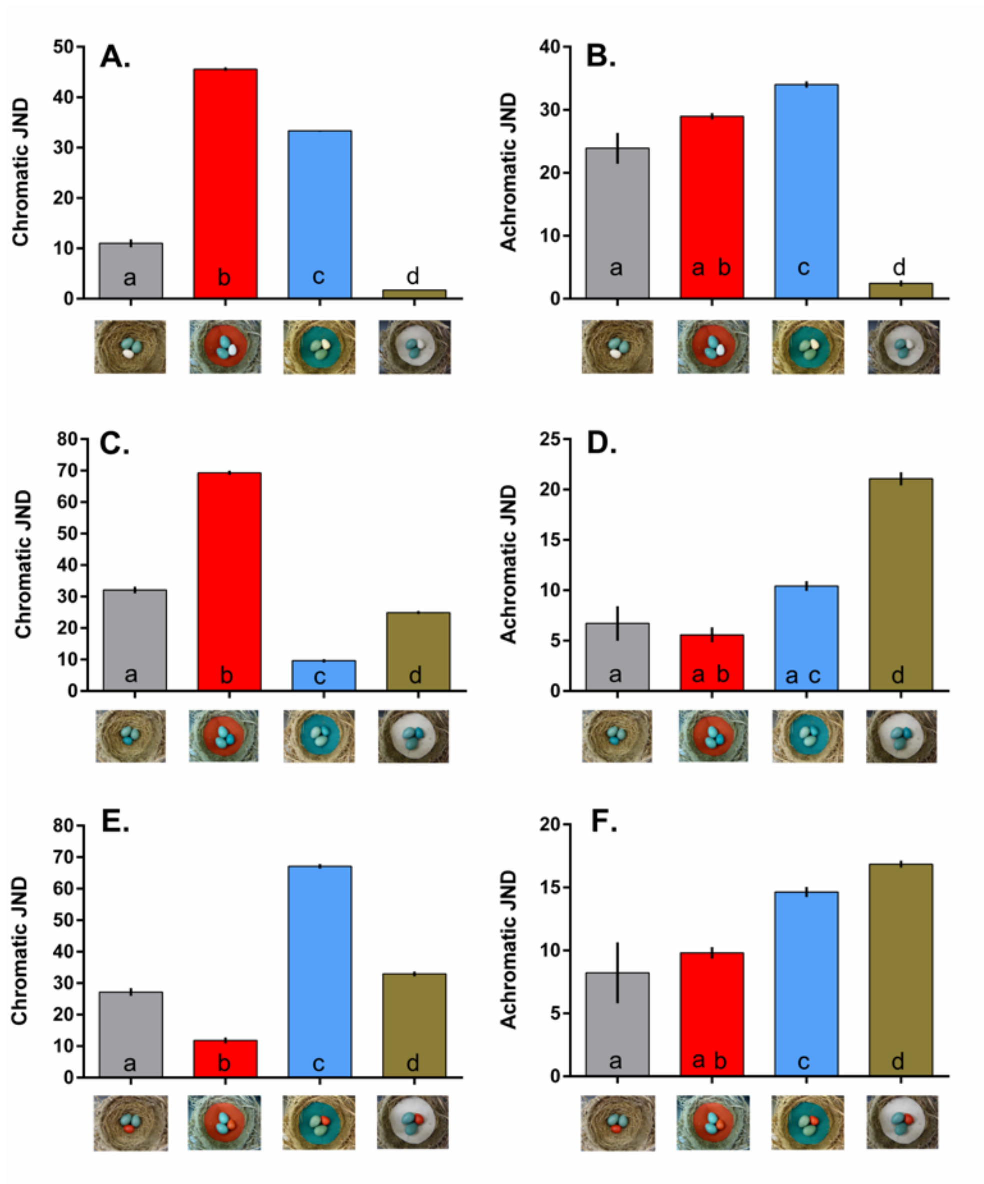

Fig. S3. (A-F) Mean (S.E.M.) chromatic (A, C, E) and achromatic (B, D, F) contrasts between experimental eggs and all nest linings using a VS visual perceptual model. Images below each column indicate the experimental egg-nest lining pair measured (from left to right: natural nest, red nest, robin-mimetic nest, beige nest). All comparisons are made using Kruskal-Wallis rank sums tests followed by Wilcoxon pairwise comparisons. Significant pairwise comparisons are indicated by letters in/above each column – columns bearing the same letter are not significantly different. In (A) and (B), beige egg-nest lining chromatic ($H_{(3)} = 45.00$, $p < 0.0001$) and achromatic ($H_{(3)} = 42.29$, $p < 0.0001$) contrasts were significant. In (C) and (D), robin-mimetic egg-nest lining chromatic ($H_{(3)} = 43.86$, $p < 0.0001$) and achromatic ($H_{(3)} = 38.65$, $p < 0.0001$) contrasts were significant. In (E) and (F), red egg-nest lining chromatic ($H_{(3)} = 44.56$, $p < 0.0001$) and achromatic ($H_{(3)} = 36.83$, $p < 0.0001$) contrasts were significant.

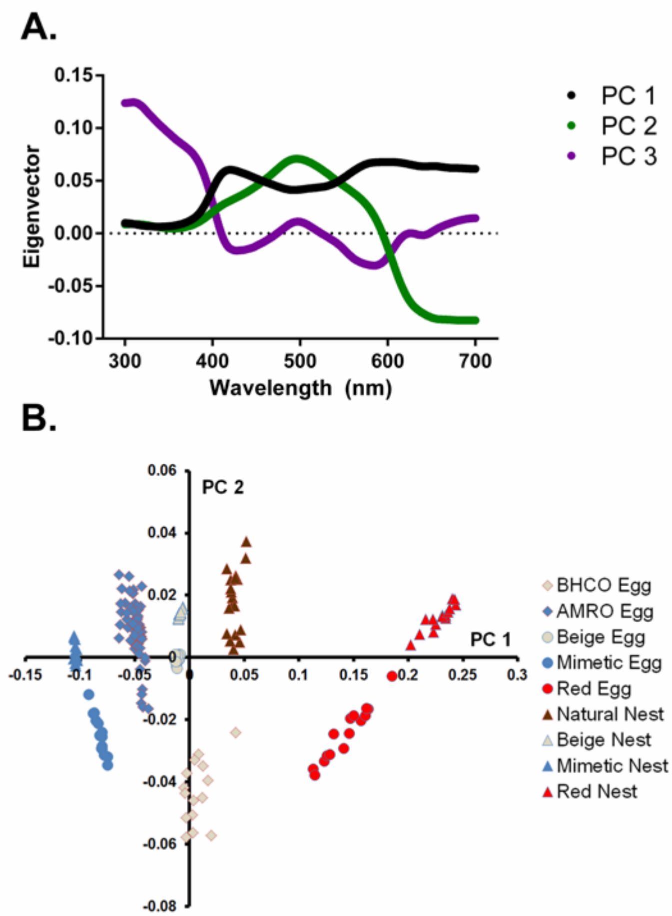

Fig. S4. (A) Eigenvectors as a function of wavelength for the first three PCs from PCA on eggs and nests. PC 1, PC 2, and PC 3 refer to principal components 1, 2, and 3, respectively. (B) PC score plot for PC 2 and PC 3 following principal components analysis of interpolated reflectance spectra of eggs and nests. The first three principal components explained over 98% of the variance in the model. PC 1 is a positive correlate of achromatic variation (Cherry and Bennett, 2001; Endler and Mielke, 2005), and explained 67.14% of the variance in our data. PC 2 (28.53 % of the variance) and PC 3 (2.93% of the variance) were used as descriptors of chromatic variation. Distances in (a)chromatic metrics between eggs and nests were calculated using both PC 1 (for achromatic distances) and PC 2 and PC 3 scores (for chromatic distances, by calculating Euclidian distances).

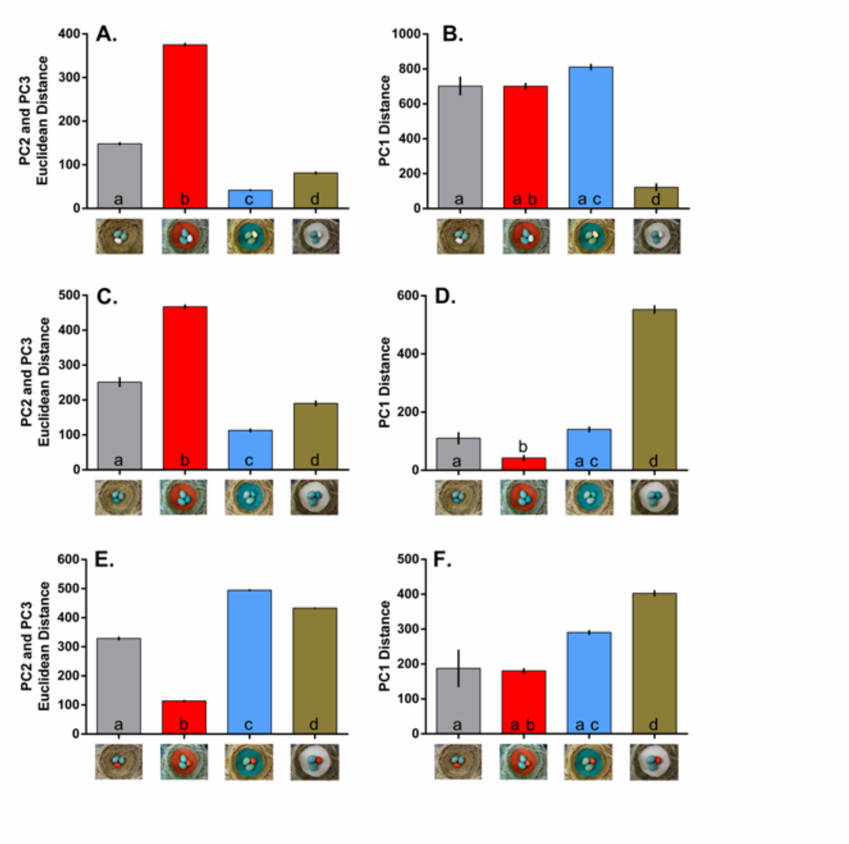

Fig. S5. (A-F) Mean (S.E.M) Euclidean distance between PC 2 and PC 3 scores (A, C, E) and PC 1 distance scores (B, D, F) from PCA on interpolated spectra between experimental eggs and all nest linings. Images below each column indicate the experimental egg-nest lining pair measured (from left to right: natural nest, red nest, robin-mimetic nest, beige nest). All comparisons made using Kruskal-Wallis rank sums tests followed by Wilcoxon pairwise comparisons. Significant pairwise comparisons indicated by letters in/above each column – columns bearing the same letter are not significantly different. In (A) and (B), beige egg-nest PC 2 – PC 3 Euclidean distances ($H_{(3)} = 45.00$, $p < 0.0001$) and PC 1 distances $H_{(3)} = 35.84$, $p < 0.0001$ were significant. In (C) and (D), robin-mimetic egg-nest PC 2 – PC 3 Euclidean distances ($H_{(3)} = 43.43$, $p < 0.0001$) and PC 1 distances ($H_{(3)} = 40.33$, $p < 0.0001$) were significant. In (E) and (F), red egg-nest PC 2 – PC 3 Euclidean distances ($H_{(3)} = 45.00$, $p < 0.0001$) and PC 1 distances ($H_{(3)} = 41.24$, $p < 0.0001$) were significant.

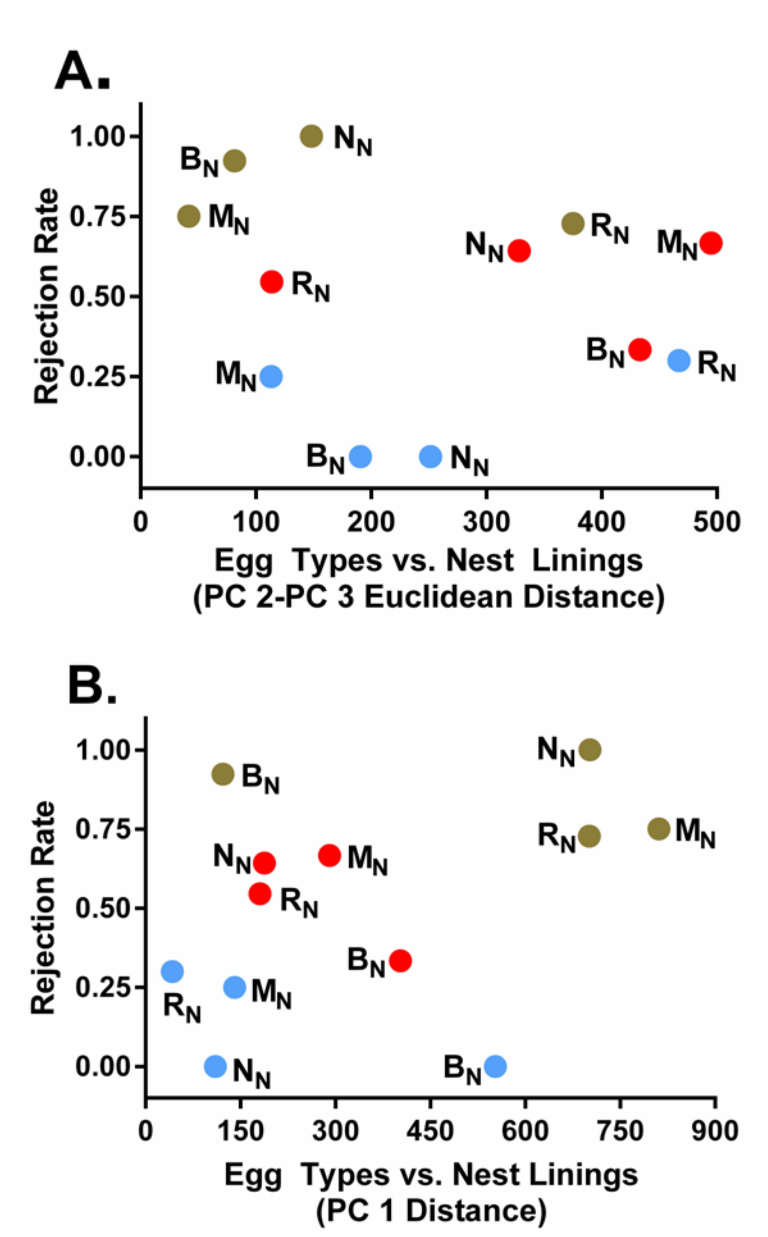

Fig. S6. The effect of model egg and nest lining color manipulations on egg rejection rates by American robins. In (A) and (B), data points refer to egg colors (tan = beige, blue = robin-mimetic, and red = red) and text refers to nest linings (B_N = beige nest, M_N = robin-mimetic nest, and R_N = red nest). (A) The relationship between PC 2 and PC 3 Euclidean distances between eggs and nest linings and rejection rate was not significant ($F_{(1, 10)}$ = 0.37, p = 0.56, R^2 = 0.04). (B) The relationship between PC 1 distances between eggs and nest linings and rejection rate was also not significant ($F_{(1, 10)}$ = 1.48, p = 0.25, R^2 = 0.13).

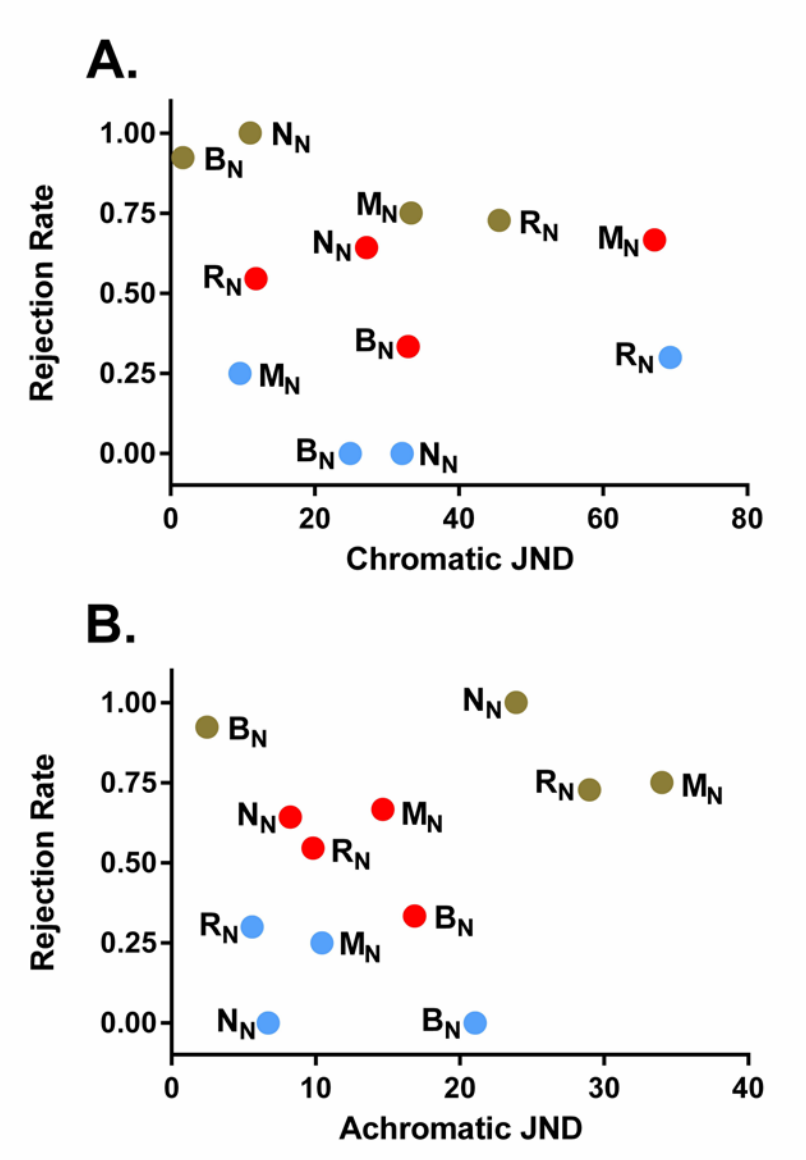

Fig. S7. The effect of model egg and nest lining color manipulations on egg rejection rates by American robins following a VS visual model. In (A) and (B), data points refer to egg colors (tan = beige, blue = robin-mimetic, and red = red) and text refers to nest linings (B_N = beige nest, M_N = robin-mimetic nest, and R_N = red nest). (A) The relationship between chromatic JND of eggs-nest linings and rejection rate was not significant ($F_{(1, 10)} = 0.32$, $p = 0.58$; $R^2 = 0.03$). (B) The relationship between achromatic JND of eggs-nest linings and rejection rate was also not significant ($F_{(1, 10)} = 0.75$, $p = 0.41$, $R^2 = 0.07$).

Table S1. The three principal components (PCs) from principal components analysis of interpolated egg and nest spectra that explain over 98% of the variance in spectral data.

PC	Eigenvalue	Percent Variance Explained	Cumulative Percent	χ^2	Df	P-value
1	58737.17	67.14	67.14	1504174	80600	< 0.0001*
2	24958.96	28.53	95.67	1416452	80199	< 0.0001*
3	2563.19	2.93	98.60	1256024	79799	< 0.0001*

Table S2. Generalized Linear Mixed Model (GLMM) fits with binomial distribution (outcome variable: accept/reject) of parameters used to assess individual robins' acceptance/rejection of parasitic eggs irrespective of egg/nest treatments. In (A), nest sites at which more than one parasitism trial was conducted were included as a nested predictor within nest lining color to test for individuals' reactions to parasitism, irrespective of nest and egg type. In (B), the analysis from (A) was re-run with two sites removed (one significant site and one site approaching significance).

(A) Multiple experiments

Predictor	**df**	χ^2	**p-value**
Whole model	33	70.25	0.0002*
Egg color	2	27.86	< 0.0001*
Site [Nest color]	33	44.23	0.03*
Clutch size	1	0.03	0.85
Presentation order	1	1.10	0.30
Experiment date	1	0.00	1.00

(B) Multiple experiments, excluding significant sites from (A)

Predictor	**df**	χ^2	**p-value**
Whole model	31	63.89	0.0005*
Egg color	2	27.03	< 0.0001*
Site [Nest color]	26	36.17	0.09
Clutch size	1	0.00	1.00
Presentation order	1	2.34	0.13
Experiment date	1	0.05	0.83