Bat vs. Rat: The Forage Files Uncovering the wild truth behind nocturnal food fights

Foundation Of Data Science - HIT140G42 - Assignment 2

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Do Bats Perceive Rats as Predators?

▶ Our fundamental research question: Do Egyptian Fruit Bats (Rousettus aegyptiacus) consider Black Rats (Rattus rattus) as real predators and not just as competitors over the food resources?

▶ This question goes beyond mere resource competition, into the complicated behavioural psychology of interspecies within common ecological environments.

Background Context: Foraging Competition in the Wild

The Setup
Black Rats and Egyptian Fruit Bats are common in the same environment, where they both tend to share the same fruits. In our study, we examine whether this rivalry develops into perceived predation.

Ecological Niche
Both species are night foragers, and frequently make use of the same fruit trees. Their interaction can be explained by understanding more about their common ecological strategies of adapting and surviving.

Beyond Competition
The objective of this study is to reveal whether the bats use predator avoidance behaviours in the presence of the rats which implies that the competition is replaced by a threat response.

Datasets Used:

Dataset1.csv: Contains individual bat landing events of 907, including whether the bat took a risk, how long it waited before going to the food, and the season.

Dataset2.csv: The second dataset 2123 observation which summarises 30-minute periods, including rat arrivals, bat landings, and food availability.

Data cleaning and preprocessing applied before analysis

Variables of core that are under examination

Risk behaviour (0=Avoid, 1=Take): group used with all comparisons.

Vigilance proxy: Time to approach food (seconds): compared between groups.

Feeding success (reward 0/1): outcome measure; the proportion of success by group.

Context: season/month and post-solar hours (assistance interpretation).

Analytical Framework We Followed

▶ Data Intake & Cleaning

Day-first time stamps were validated, key fields coerced to numbers, missing/bad rows had been removed, and time-to-food values stored as non-negatives.

▶ Feature Definition

Defined risk behaviour (0=avoid, 1=take), approach to food time (s), feeding success (reward 0/1); observed context fields (season, hours-after-sunset).

▶ Descriptive Exploration

Summarised distributions and counts in groups; plotted the success-rate bars and time-to-food histogram to observe pre-test patterns.

▶ Inferential Testing

Approach-time differences between approaches Mann-Whitney U used and success-rate differences Fisher test with clear terminal conclusions (0.05).

▶ Visualisation & Reporting

Obtained readable hist/bar charts with legends, and percent labels, and a black font Word report created using a reproducible Python script.

Time to approach food by risk behaviour (histogram)

Success rate by risk behaviour (bar graph)
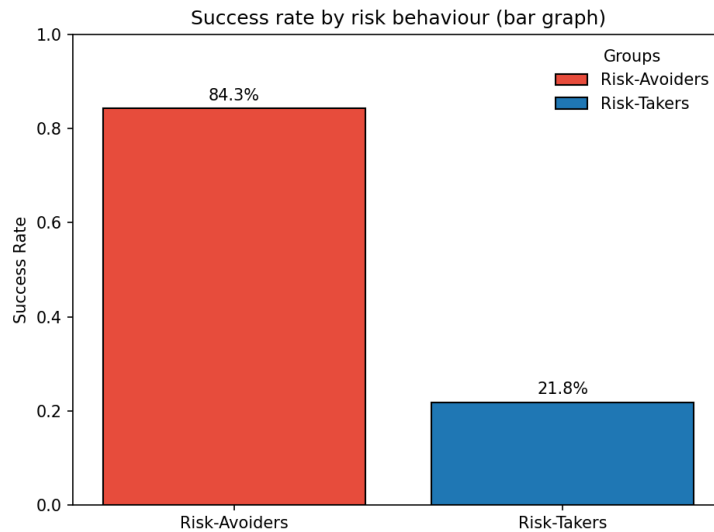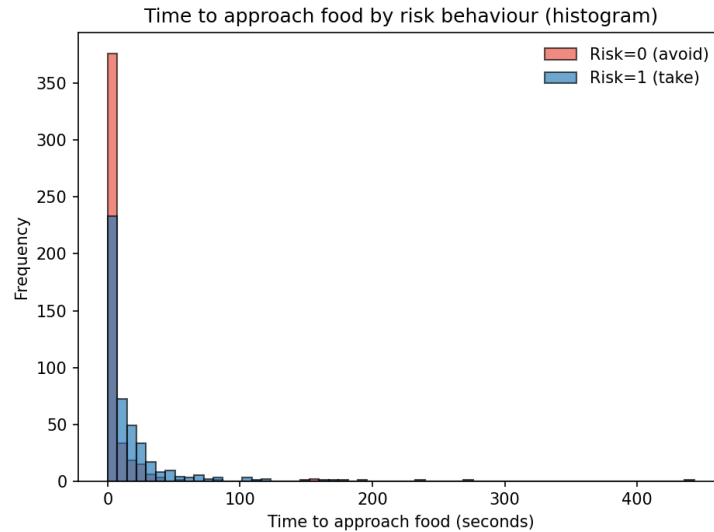
Detailed Analysis (Graphs)
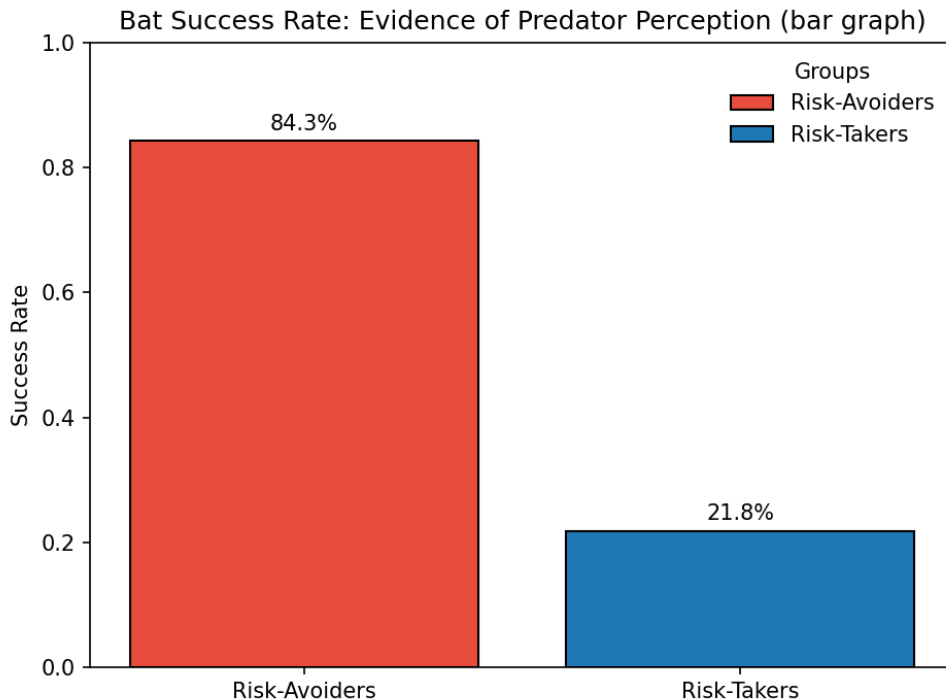
Final outcome: Through detailed analysis

Bat Success Rate: Evidence of Predator Perception (bar graph)

Risk-averse bats have a foraging success rate of 84.3%, versus only 21.8% when taking risks- a large difference that indicates that being risk-averse, predator-sensitive behaviour does work. The trend is a solid argument in favor of the opinion that bats view rats as potential predators and not competitors only, and the vigilance will yield better results in the food platform.

Statistical Evidence of Predator Perception Results Summary: Significance and Effect

▶Good sample size and balance: n=907 (do not take n 0=458, take n 1=449) gives fair comparison.

▶Huge success gap 84.3% (avoid) vs 21.8% (take); exact p -value of Fisher = 4.92 x 10 -85 to the power of highly significant.

▶Approach-time difference: Mann -Whitney U = 68,002; p = 8.43x10 -9 = preventers are slower to react (vigilance signal).

▶Bottom line: There is overwhelming evidence that bats see rats as predators- avoidance/vigilance has even greater success.

Statistical results (formatted table)

Test	Variables	Statistic	p value	n	Interpretation	Graph
Context (proportions)	success rate ~ risk group	avoid=84.3%, take=21.8%	Fisher=4.92e-85	n0=458, n1=449	Observed success proportions by group (same values in Fig 2 & Fig 3).	Bar chart
Mann–Whitney U	time-to-food ~ risk (0=avoid,1=take)	U=68002	8.43e-19	n0=458, n1=449	Non-parametric group difference in approach times.	Histogram (frequency)

Dataset 1 – key descriptives

	count	mean	std	min	25%	50%	75%	max
bat_landing_to_food	907.0	11.713	27.644	0.01	1.0	4.0	11.5	443.0
risk	907.0	0.495	0.5	0.0	0.0	0.0	1.0	1.0
reward	907.0	0.534	0.499	0.0	0.0	1.0	1.0	1.0

Records: 907

Findings & Future Directions

▶Perception Confirmed:

We have analyzed this to regard bats as predators of rats, and not merely as competitors. Risk-averse bats take more care and find considerably greater success at the platform, which is also predicted by predator-vigilance theory.

▶Supporting Evidence:

Approach times: Group difference at significant level (MannWhitney U) whereby approach takes less time in avoiders.

Result: Feeding success: avoiders (84.3) vs takers (21.8): There is a very significant difference in the numbers presented by Fisher.

The collective of behaviour, and outcomes, refer to adaptive caution.

▶Broader Implications:

The results shape behavioural ecology and predator-prey interactions in common environments to inform enrichment/management approaches and conservation choices in co-occurring bats and rats.

▶Limitations & Next Steps:

Season/time-of-night, individual variation and direct rat presence/intensity were controlled. Further analysis: preregistered analyses and models that would measure the vigilance thresholds.

Acknowledgements

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TEAM COLLABORATION
MADE THE PROJECT
SUCCESSFUL