Risky Business: Boldness in Crickets

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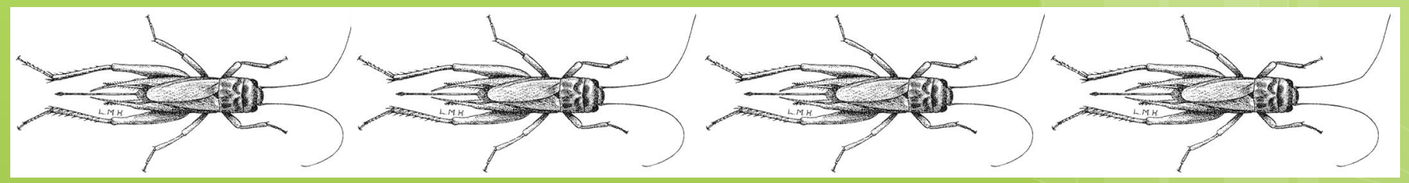
On the population level, individuals of the Acheta domesticus, or, the house cricket, can be classified into certain behavioral syndromes. These syndromes can be distinguished into two categories: **shyness** and **boldness**.

The behavioral syndromes can differ based on external stimuli; This study focused on cricket's risky behavior in presence of a predator.



Why crickets ?

- Well-studied: readily avaliable literature on the species
- Affordable and readily avaliable subjects
- *Normally* simple to house and keep alive
- Distinct and observable predator-prey relationship
- Easy to determine males from females
- Multiple trials possible within a short period of time
- Possibility of introducing multiple variables (like food and prospective mate)

Experimental Design

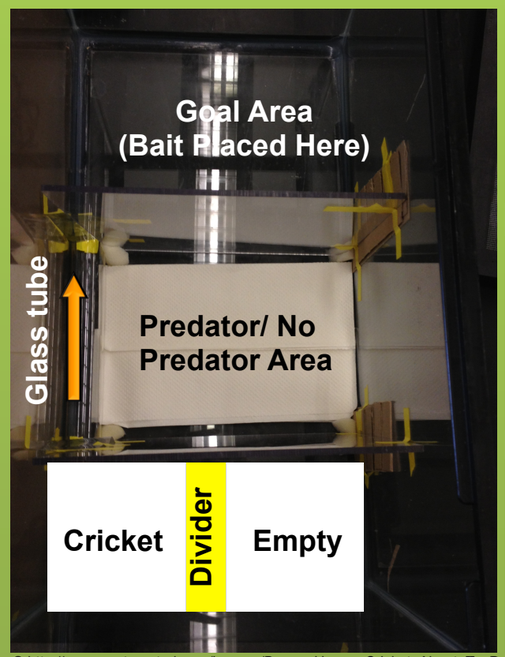
Studies have demonstrated that male crickets will engage in bold behavior in order to attract a mate, and also immediately following a simulated predator attack (Niemela et al. 2012, Wilson et al. 2010). Based on these and other previous studies, a hypothesis for a new study was formulated.

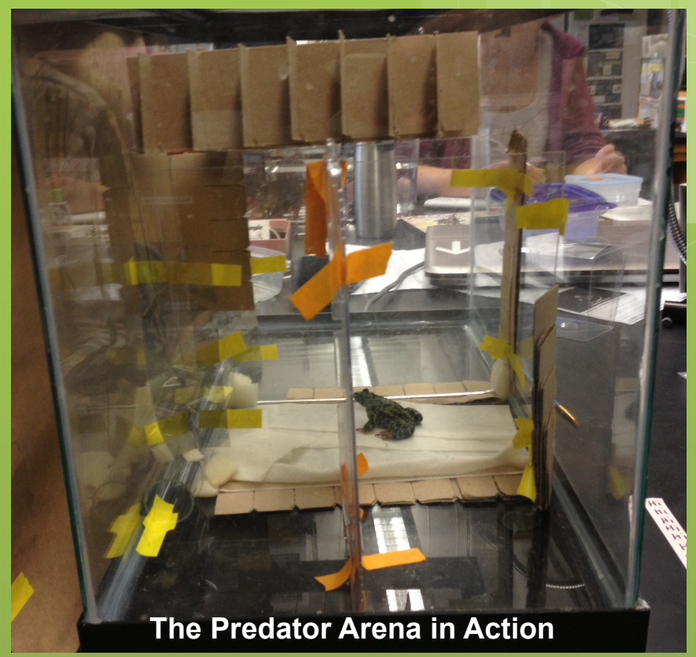
Hypothesis:

Male crickets will engage in less frequent risky behavior (i.e. crossing the arena) with a predator present, and that this risky behavior can be modulated by baiting the subject with food or a female cricket.

3 Conditions:

Control, Food, and Female [tested both with a predator (Bombina orientalis, Fire Bellied Toad) present and without, 1 male cricket per arena (2)]




The Predator Arena in Action

© http://www.pest-control.com/images/Brown_House_Cricket_About_To_P_5992617.jpg

Methods:

- For each condition there were 30 3-minute trials (10 P, 10 NP), with a male cricket in each arena, with a predator or no predator (P or NP)
- After 5 trials crickets were switched from P to NP, and after 10 new crickets were selected from the cricket population
- Latency measured for crickets to cross the arena (sec)
- 1/0 sampling done to record cross vs. no-cross behavior

Results

The 180 trials were analyzed using JMP to run a two-way ANOVA, and a chi-squared analysis.

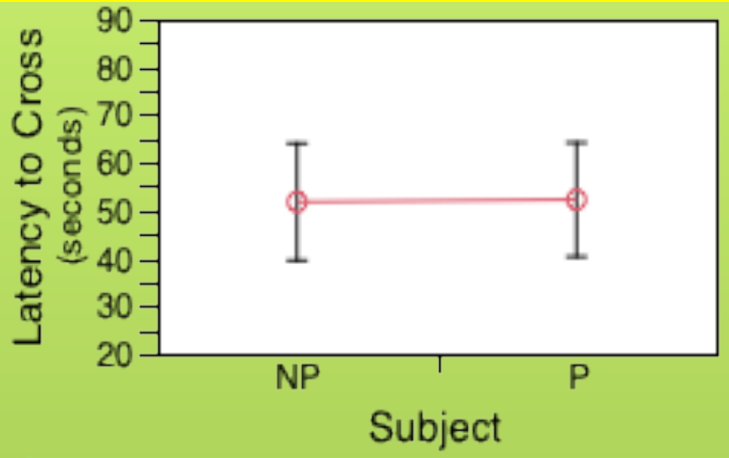


Fig 1. Graph showing latency to cross[a] (in seconds) in male crickets by subject (NP or P) without regard to testing condition.

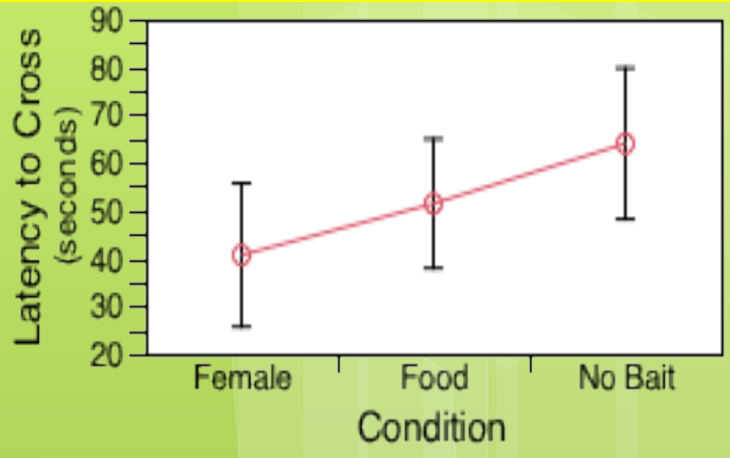


Fig 2. Graph showing latency to cross[a] (in seconds) in male crickets by condition (Female, Food, or No Bait) without regard to subject.

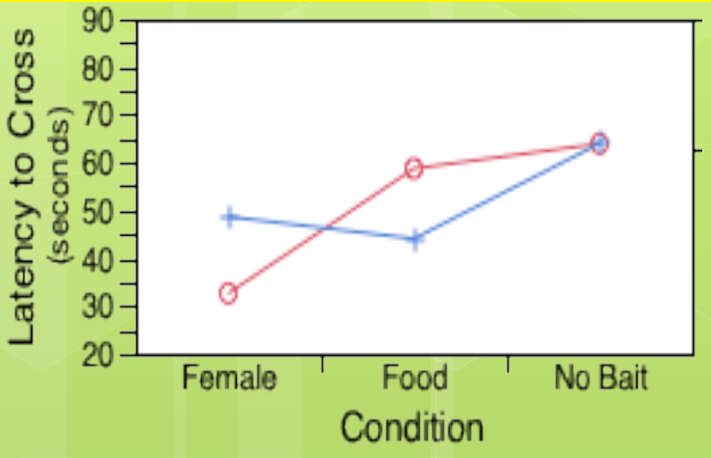


Fig 3. Graph showing latency to cross[a] (in seconds) in male crickets by condition (Female, Food, or No Bait) for each subject, NP or P (red or blue).

a. Latency to cross was measured from beginning of the trial when the timer was started and the crickets were dropped into the testing arenas, to when the cricket went through the glass tube and crossed into the opposite, divided area, past the predator (present or absent) area.

What did the data say?

1) The mean latency to cross was not statistically significantly larger in the NP group (51.46 sec) than the P group (51.52 sec) (Two way ANOVA, F = 0.003, df = 1, 135, P= 0.9576).

2) The mean latency to cross was not statistically significantly between the three conditions (40.5, 51.3, and 64.0, respectively) (Two way ANOVA, F = 2.2, df = 2, 135, P= 0.1106).

3) There was not a statistically significant interaction effect between the different subject*condition pairings (NP/Fem, NP/F, NP/NB, P/Fem, P/F, P/NB; 10.6, 9.8, 11.7, 10.9, 9.6, and 10.9, respectively) (Two way ANOVA, F = 1.1, df = 2, 180, P = 0.3255).

Count Expected Cell Chi^2	Cross	No Cross	
NP	66 67.5 0.0333	24 22.5 0.1000	90
P	69 67.5 0.0333	21 22.5 0.1000	90
	135	45	180

Table 1. A contingency table for the chi-squared analysis of Subject by Cross for 180 trials (90 for each subject[a]).

a Subjects (2, P & NP) were substituted for another male house cricket from the population every 10 trials, and switched between arenas (P & NP) every 5 trials.

What did the data say?

1) The observed counts cross/no cross behavior were not significantly different from those one would expect by random chance alone. (Chi Square, X2 = 0.267, df =1, p = 0.6055).

Count Expected Cell Chi^2	Cross	No Cross	
Female	43 45 0.0889	17 15 0.2667	60
Food	53 45 1.422	7 15 4.2667	60
No Bait	39 45 0.8000	21 15 2.4000	60
	135	45	180

Table 2. A contingency table for the chi-squared analysis of Subject by Cross for 180 trials (60 for each condition[a]).

a Subjects (2, P & NP) were substituted for another male house cricket from the population every 10 trials, and switched between arenas (P & NP) every 5 trials.

What did the data say?

2) The observed counts cross/no cross behavior were significantly different from those one would expect by random chance alone. (Chi Square, X2 = 9.991, df =2, p = 0.0068).

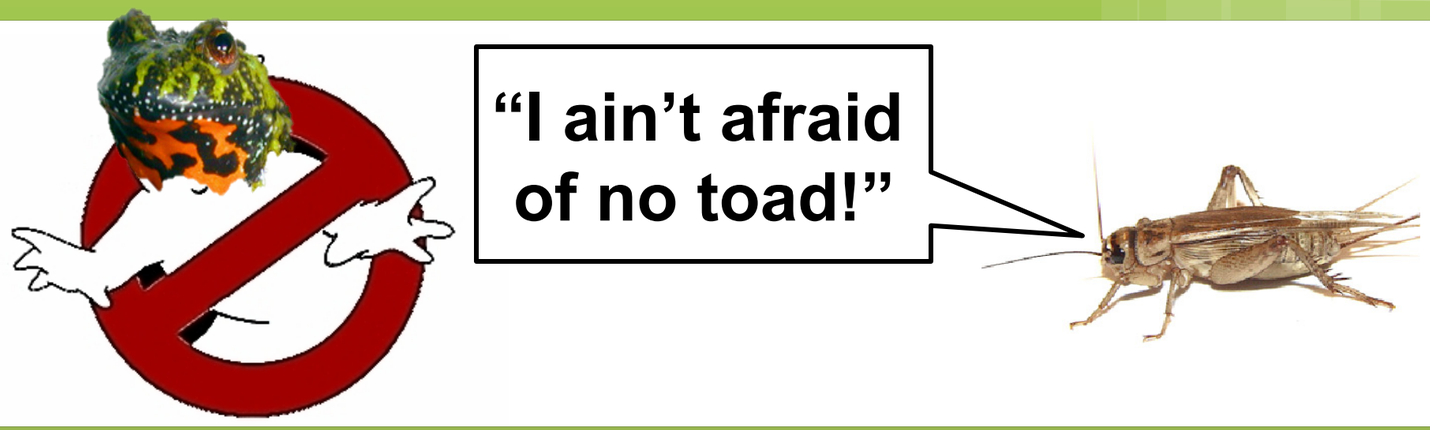
It *seems* as though Food caused an increase, and No Bait a decrease in behavior.

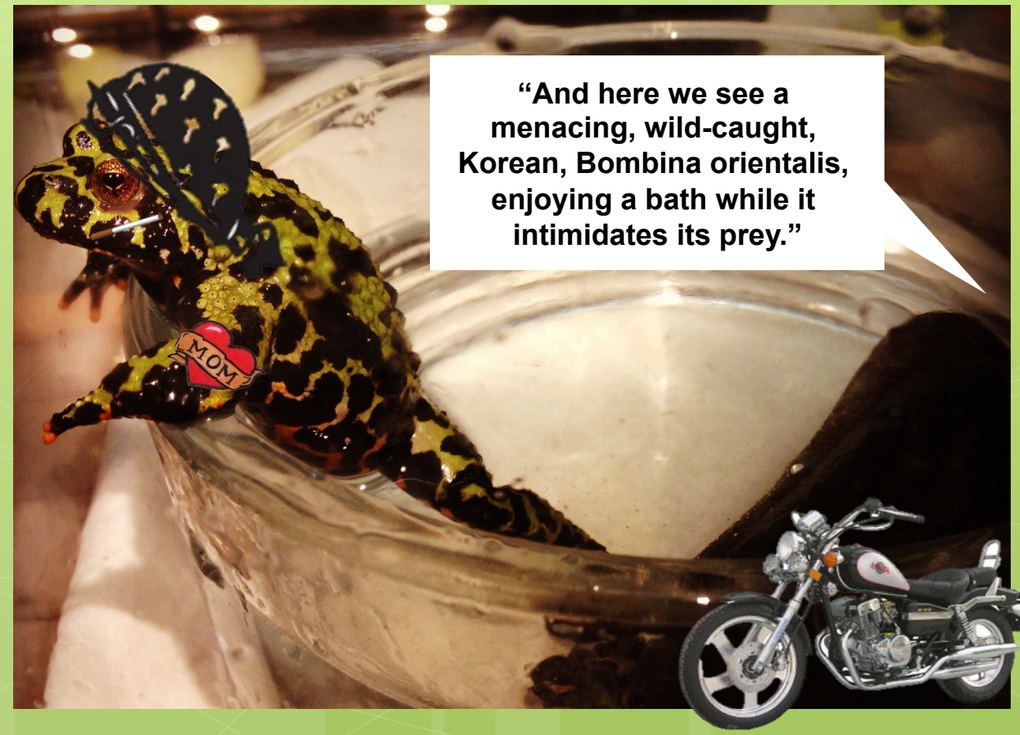
Conclusion (s)

Based off of the two-way ANOVA, the latency to cross the arena with a predator was **not** significantly greater than crossing without. Based off of the chi-square test we could **not** deduce an increase in risky behavior, but by looking further into the data we **could** infer that the condition alone (*apparently* food and female) showed a change in the amount of risky behavior (i.e. crossing the arena).

Future Directions:

- Use different species of frog for a distinct effect.
- Use different set ups so that can increase the cricket's perception/visibility of the threat. For example, placing the cricket in a vial and put the vial in the arena with the frog.
- Use a new cricket every single trial.





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