Do Intruders Alter Behaviors of Parent House Sparrows?

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All data was collected by Carleton externs while under the supervision of Dr. David Westneat. Parental behavior (feeding and nest defense) was measured from videos taken in 2013 and 2014 of adult house sparrows at nest boxes in a free-living population at the University of Kentucky's Agricultural Experimental Research Station, in Lexington, Kentucky.

Statement of Data Analysis

When the pair sparrows notice there is a starling or other intruder around the box, do they increase their time spent in and around the box in order to protect the nest? In my first scored video in particular, when there was an active starling around the nest, my curiosity was triggered. ***My hypothesis is that as risk increases around the nest, parents will detect that and shift their care to the more valuable activity, such as protecting their nestlings at their nest.***

To assess this hypothesis, I will measure the time individual parents spend at the box in data sets with different amounts of intruder visits. At first I considered looking at “recent” intrusions before realizing that the running time of each video, which the data was collected from, instead calls for looking at the whole video and the amounts of intrusion holistically, as the videos represent a small time segment of a sparrow’s natural environment.

Statistical Analysis

During the course of this project I learned how to use R studio not only to model and identify the correlation between dangers of intruders and parental behavior, but also to summarize such a correlation through several telling statistical values proving the correlation. I learned first how to add a separate value to a data chart in R based on data already collected, in this case total time intruders spent at the box. Then, I learned how to create a linear mixed model between the random effects based on fixed effects. In this case, intruder visits and time the parents spent around the nest were random effects while the band and breed ID of the subject birds were fixed effects as they don’t influence the correlation (s5 <- lmer(TimeAtBox ~ 1 + Intruders + Sex + (1|Band) + (1|BreedID), data=Extern_summary) summary(s5)).

Additionally, the total time of the sparrows at their boxes are measured relative to the length of the video taken in which they were observed, which I had to create a new variable for.

This is done in order to eliminate the difference in video length as a factor in the correlation between the variables.

Results

I found a positive correlation between the amount of intrusions and the time individual parents spent at the box (Figure 1; 133 +/- 52 secs, $t_{1,5.8} = 2.5$, $P = 0.047$). I also found females spent significantly more time at the box than males and increased with the number of intruders relatively linearly(Figure 3; 988 +/- 290 sec more, $t_{1,21.9} = 3.4$, $P = 0.0025$). On the other hand, males seem to at first spend less and less time at the box as there are more intrusions until around 4 intruder visits, where they spend more and more time at the box as there are more intruders, increasing their time at the box at an accelerated rate.

In Figure 4, our data shows a p value <0.05 between intruders and relative time at box, meaning the data is significant and there is little evidence of the correlation between total time at box and intruding visits being a consequence of chance.

The large spread of outliers may be attributed to nestling age, climate variation, environment, danger factor of the intruder, or other factors which we cannot measure. For example, in my observation of file BB14_7_1_14, The long amounts of time the birds are spending in the nest could be explained by the changing colors of the sky along with the shaky camera, indicating poor weather conditions that may call for increased attention to the nestlings and also shelter for the sparrows themselves. Although there were no intruders throughout the observation, time at the nest was high because of the weather conditions. Additionally, intruders are probably less likely to intrude when there are poor weather conditions as extra travel to the box would prove to be difficult.

Conclusion

Based on our data and its corresponding plots, we can conclude that there is a significant positive correlation between intruder visits and the time parent sparrows spend at their nests. From this we can infer that since intruders pose a certain danger to nestlings and the nest as a whole, parental house sparrows' behavior becomes more protective and they tend to spend more time at the nest as intruders visit more often.

Figure 1

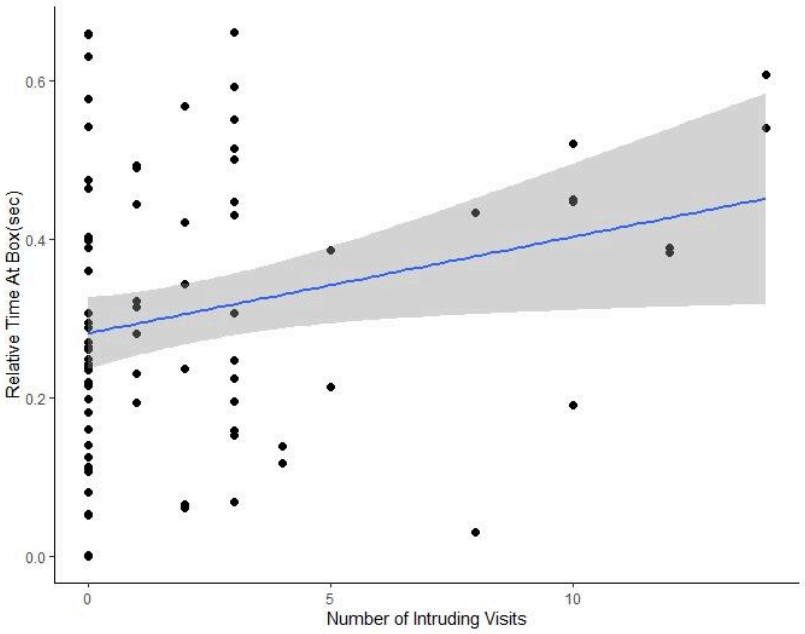

Figure 2

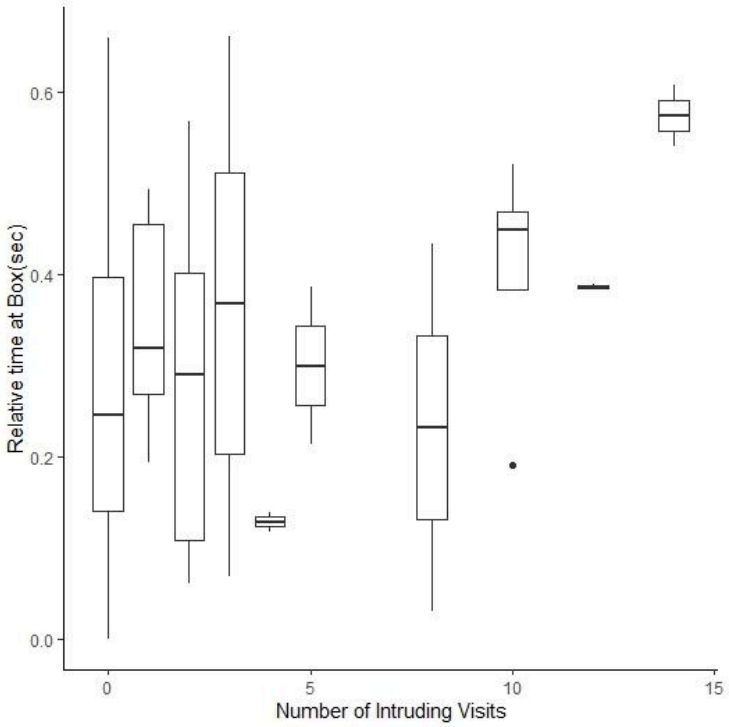

Figure 3

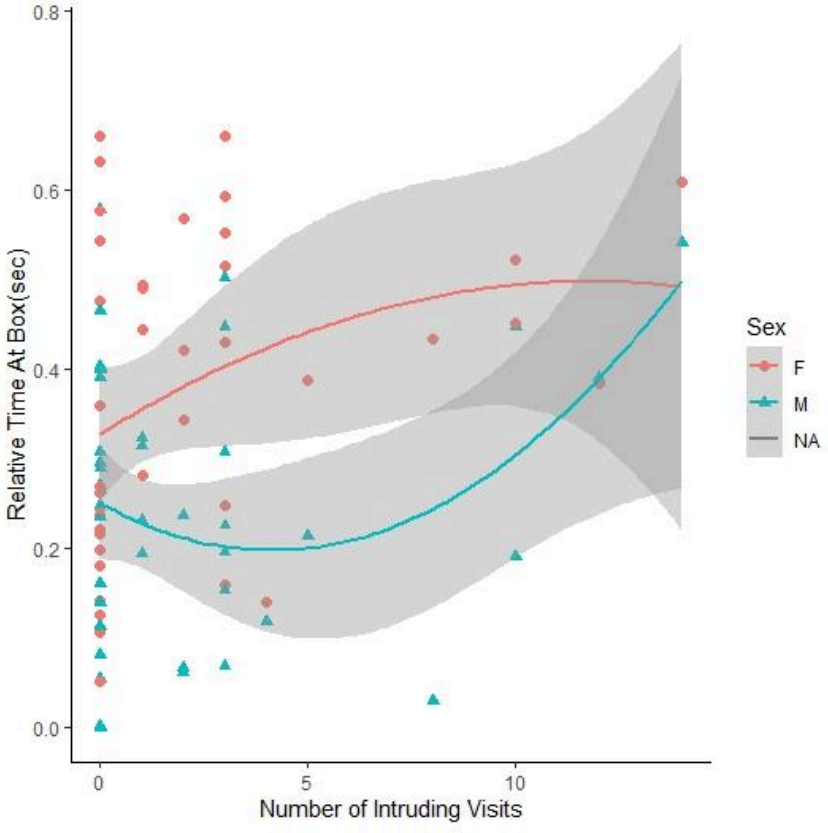

Figure 4

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Scaled residuals:
     Min       1Q   Median       3Q
-1.84519 -0.77351  0.05433  0.62051
     Max
 2.08002

Random effects:
 Groups   Name        Variance Std.Dev.
 Band     (Intercept)  107300   327.6
          Intruders     10711   103.5
 Residual              1355550  1164.3
 Corr

 -0.50

Number of obs: 84, groups:  Band, 29

Fixed effects:
            Estimate Std. Error       df
(Intercept) 2633.647    223.245   23.709
Intruders    133.253     52.945    5.768
SexM        -988.066    289.626   21.889
            t value Pr(>|t|)
(Intercept)  11.797 2.09e-11 ***
Intruders     2.517  0.04705 *
SexM         -3.412  0.00251 **
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Signif. codes:
  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’
  0.1 ‘ ’ 1

Correlation of Fixed Effects:
          (Intr) Intrdr
Intruders -0.399
SexM      -0.648  0.000
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