

Rolling the Dice with Mice Personality.

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Abstract

To examine personality in the deer mouse (*Peromyscus maniculatus*), I presented individuals with different types of food to determine their preferences for food type, and amount eaten of those foods. Personality traits such as boldness, activity level, and shyness have been examined in many of the world's animals. Surveying an animal's habitat and the productivity can lead to knowledge of an individual's personality traits. Understanding the personality of an individual can provide insights into its interactions with the environment. *Peromyscus maniculatus* are very mobile and safe to say that each mouse demonstrates some boldness. In addition *Peromyscus* are nocturnal and their defenses are hiding and sleeping throughout most of the day to avoid potential predators. In this case there are very careful treading lightly to scurry from predators provoking a shy approach to every obstacle. When the mice come out to forage it is at night on the hunt for *Acer saccharum* (Sugar Maple) and *Acer rubrum* (Red Maple). *A. saccharum* being dominant one might think of that as a preference over *A. rubrum* that is what this paper and the trials are about. My predictions are that the mice with a bold personality will have a preference of a Sugar maple seed and the shy mice will have the preference of the red maple seeds.

Introduction

Individual personality traits (PTs) are important indicators of mouse behavior. Previous research has found that boldness, activity, and/or aggression are positively related to food intake rates, productivity, and other life history traits in a wide range of taxa (Brio & Stamps 2008). Foraging is important because every species eats to stay healthy and survive. A tertiary animal eats animals lower on the food chain for survival. A species has to forage to retrieve energy then the energy passes up the food chain. *Peromyscus maniculatus* are granivores (Seed eaters) and eat a variety of seeds (King 1968).

Animal personality traits (PTs) can be defined as behavioral tendencies that dominate the instincts of the animal. The traits are usually consistent throughout the population of species across a duration of time (Brio and Stamps 2008). These personality traits are important to understanding what instinct a given species will show or what can be expected from an animal. Activity, shyness or boldness, exploration, aggression and socialability are the five general categories of animal traits. (Brio and Stamps 2008) Activity level can be defined as an organism's movement and willingness to be mobile. Shyness can be associated with non-movement and little activity. Boldness is a trait in which the species is active with a response to risky situations. Exploration can be identified as an animal that venture out to new places, curiously searching unidentified areas, response to novel situations (Brio and Stamps 2008). Aggression has to deal with either the individuals of different species or same species showing angry tactics or actions toward one another. Sociability is the act of gratifying attention to another individual indicating a sense of communication. With my experiments I will test boldness and shyness for the Deer Mouse (*Peromyscus maniculatus*). The mice were examined with a series of observation and feeding techniques for evaluating the mouse's personality.

My study focuses on PTs of the deer mouse (*Peromyscus maniculatus*). *Peromyscus* have high survivorship due to their small size and quickness, presenting mouse indicators of PTs. Animal personality traits (PTs) can be defined as behavior tendencies that apply instinct to various situations. The traits are usually consistent throughout the population of species across a duration of time (Brio and

Stamps 2008). *Peromyscus maniculatus* are a staple diet for snakes, owls, weasels, foxes, wolves, domestic dogs and house cats. (King 1968; Kelvin 1960). At UNDERC the property is all forest giving the mice plant seeds to eat such as *Acer saccharum* (sugar maple) and *Acer rubrum* (red maple). The foraging of these seeds are experimented with tests that comprise the two types of personalities. Two personality traits will effect foraging, bold mice eating more of the *Acer saccharum* and the shy mice eating *Acer rubrum*. The bold mice would want the bigger seed that is harder to access for the size of the seed. The shy mice will have the preference of the easily accessed smaller seeds for the little effort to eat the seed. These are my predictions for the two personalities and the effects on foraging.

Materials and Methods

I conducted my study at University of Notre Dame Environmental Research Center (UNDERC) in Land O' Lakes, Wisconsin. UNDERC has a wide variety of habitats ranging from undisturbed woodlands (forest) to undisturbed woodlands with an abundance of *Acer saccharum* (Sugar Maple) and *Acer rubrum* (Red Maple). My plots were located in woodland areas with various heights of trees: tall trees that had time to grow and saplings that are still growing on understory. The sampling sites where the mice were retrieved was a grid that had 25 points that was set 15 meters apart. Sherman traps were set in the evening and checked in the early morning for captured *Peromyscus maniculatus*. Captured mice were measured for body mass, ear, and body length, and an ear biopsy was collected for other studies. Sex and reproductive status (active vs. inactive) was noted. Mice less than 15 g and nursing or pregnant females were not used for trials.

Mice were taken to the lab and housed in a metal rectangular cage with corn cob bedding to substitute substrate. Mice were given access to water, a dome shape cover was given with cotton for shelter and nesting. Food was given and left for the mice to eat anytime. All the requirements of the IACUC were enforced to take better care of the mice.

Mice were starved 5 hours prior to trials. Personality was measured using two tests, the open field test and the hole board test. The open field test measures boldness and shyness based on the number and duration of squares in a 3 x 3 grid entered by the mouse. The central square was an indicator of the mouse's boldness displaying willingness to stay longer in the middle (Carrey et al. 2000). The center square is out in the open with no cover, away from the corners (a place to hide) making the center square the most indicative of boldness. The number of times the central square was entered and not entered indicated which syndrome (behavior) the mice exhibited. Mice that enter the center square more often and stayed in the center were considered bold. Shy mice were more sedentary and did not move in to the center square as much demonstrating an unwillingness to explore.

The second test was the hole board test (HBT) in which a box was built with 16 holes drilled on a platform. The holes were carefully measured drilled away from one another at equal measurement to create consistency. A screen was then glued on the bottom that stopped the mice from going through. The hole board was enclosed inside an aquarium apparatus shut closed with a plastic lid. The HBT presents the mice with an obstacle of holes they could not enter to see how many attempts were performed. The more attempts that a mouse made indicated a bolder personality. Mice that had little focus on the holes were the mice that did not explore and sat in one place showing a shy personality. The hole board test focuses on specific head dipping behaviors in which an individual explores by

sticking its head into a hole. Head dipping, therefore is the indication of direct exploration (Hart et al 2008), mice venturing in areas unexplored. The mice with more attempts to enter holes showed direct exploration and movement indicating a bold personality. Having little movement and displaying any attempts to escape, the mice with little or no holes explored and remaining stationary were marked down as shy.

The syndrome (bold or shy) of the mice was determined with the trials, monitoring actions of the mice while in apparatus. After determining the mice bold or shy the food was measured and calculated. To indicate whether the syndrome affected amount eaten of seeds *Acer saccharum* (Sugar Maple) and *Acer rubrum* (Red Maple). A selectivity index (Cramer 2014) was used to assess preference of foraging mice to each seed type. A value of 2 indicated complete preference for *A. saccharum* and a value of -2 indicated complete preference for *A. rubrum*.

Night owl infrared security cameras were used to record the mouse during both trials. The cameras were placed over head for both trials at a reasonable distance to get a full view of the 10 minute trials. Between trials the apparatus was cleaned with water mixed with 10% bleach to eliminate olfactory cues. Individuals were tested in the dark in order to stimulate their natural activity pattern. After the trials both mice were given 5 grams of red maple seeds and 5 grams of sugar maple spread inside the housing cage. The mice stayed inside the cage with the *A. saccharum* and *A. rubrum* seeds throughout the night. The next morning each mouse was transported to another cage and the seeds were recovered to be separated. After the separation the seeds were put into a drying oven for a day to get moisture out for accurate results. Reviewing the video of the mouse recording the data with jwactcher and applying the data with the amount eaten the recording the results. The data that was collected from the experiments formed the outcome of all the parts we needed for results. The stay for the mouse was three days, after the mouse was required to be released. We stayed within the IACUC rules and regulations.

Statistical Analysis

The proportion was taken and given for every mouse that participated and was done for the seeds *A. saccharum* and *A. rubrum*. None of the proportions for red maple went over 0.974283 and no lower than 0.515723. The sugar maple did not go any higher than 0.484277 the lowest point of proportion for sugar maple was 0.025717. The next study was the selectiveness of *A. rubrum* and *A. saccharum*, this was done by taken the proportion and divide by a 5/10 equation which came to .5. Every proportion was divided by the equation given up above and thus the selectiveness of every seed type was calculated with different results. The results were outstanding for Red maple 1.948567 was the highest the lowest amount was 1.19195 in the proportion calculation. For the sugar selection the max limit was 0.968553 the lowest number was 0.80805 the lowest number for both red and sugar maple was attained by the same mouse. The index was simply subtracting the selection of Red and Sugar and coming up the index which gives us the type of seed that was preferred by the particular mouse that ran the trial also entering the factor of the syndrome. The graph represents the difference between in selectivity between bold and shy mice.

The means t test, data measured amount eaten. Step by step.

Results

Twenty *Peromyscus maniculatus* were put through the hole board and open field test looking for behavioral syndromes relating to a bold and shy continuum. Eleven mice were shown to be shy after combining the two trial test numbers of factor cues: heading dipping in holes and venturing in the center square. Nine mice exhibited bold behavior by exploring more holes (hole test) and spending more in the center square (open field). Eleven mice were found shy not exploring or not much head dipping. The hole board test was distinguished by number of holes explored, 9 and under being the shy category, 10 and above being the bold category (Figure 1). The open field test was done with amount spent in the center square. Although 5 cases were distinguished differently with other factors of the trials were used to determine the syndromes because the 5 mice were not consistent. Overall the results came to no preferences such as I thought they would the bold mice did not eat red maple more than sugar maple. The shy mice did not eat the sugar maple more than red maple as I intended. Both syndromes eat at an equilibrium of seeds and had no real difference. I found no significance in preference in the behavior syndrome toward type of seed eaten.

Discussion

My results revealed there was no difference in preference towards the two types of seeds between the bold and shy behavioral syndromes. Sugar maple seeds are larger than red maple seeds, however, they are more difficult for deer mice to open. The thin shell of the red maple was easily broken for a forager to access and eat the small seed. These factors effected results making them both equally eaten for both syndromes. Looking at it from the mouse's point of view while foraging or eating a seed the mouse would be out in the open for predators to see. The mouse would rather not be food for predators, but to be cautious, eat quickly and get back to shelter. Given the seed structure the deer mice would have to eat an easily accessed small seed or a time consuming big seed.

Between seeds the preference was equal because there was what is called "safe patches" in which no threat was present while foraging (Valentina. M 2015). A foraging test was conducted with toxic seeds applied creating a threat for mice when foraging. When a threat was present i.e. toxin, the mice had foraging constraints for the toxin laced seed making the non-toxic seed more preferred. The toxin concentration on seeds reduced bout size, feeding rate and total intake during foraging trials (Valentina S. A. Mella 2015). The personality of a bold mouse would likely search for more edible seeds thus searching for more ways to escape dipping their heads into more holes. The shy mice will take the time to examine the seed and the surroundings just as they sit to look for threats and listen rather than exploring the foreign environment.

For better results different trials that indicate behavior syndrome would give us a better perspective of personality and how it effects foraging. If there was another mouse in the trial a different species such as the jumping mouse one of the two species would have a preference. The preference could be measured and included into more research. In order to make my research more efficient factors need to be introduced to trials. The marble burying test would shine light on the syndrome. The burying test is filling the cage with 5 -10cm deep with wood chips making a rectangular of marbles and counting the marbles buried (Gulinello 2009). The time frame is 30-60 min. the number marbles buried will indicate behavior in this case bold or shy. The Marble test requires digging it can be associated to buried seeds that the mouse has to dig to eat. There are different factors to marble test putting tabasco sauce on marbles to increases burying (Gulinello 2009). The sauce smell could attract the mice when to

strong of a scent the mouse could want to get rid of it. The sauce scent will tell us the mouse's smell sense and the extent of finding seeds with their nose.

Acknowledgments

All the information from the very start to the very end made it possible for results, stats collaboration of data and to find the answers to the questions above. The field work with the Sherman traps, housing the *Peromyscus maniculatus*, running trials late at night and preparing the cage for after trials. Setting the camera just right to get a full view. Watching the videos after it was recorded while entering data into the computer. To writing this paper was an experience I will not forget for this is my first major science project that was taken seriously by my mentor and myself which was reviewed again and again for corrections. I am proud to call this my work and looking forward to applying the knowledge I have achieved here to all my future works academically and everything else I do in my life.

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Dr. Maria Gulinello Behavioral Core Facility Albert Einstein College Of Medicine Behavioral Core Protocols and Training.

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Figures

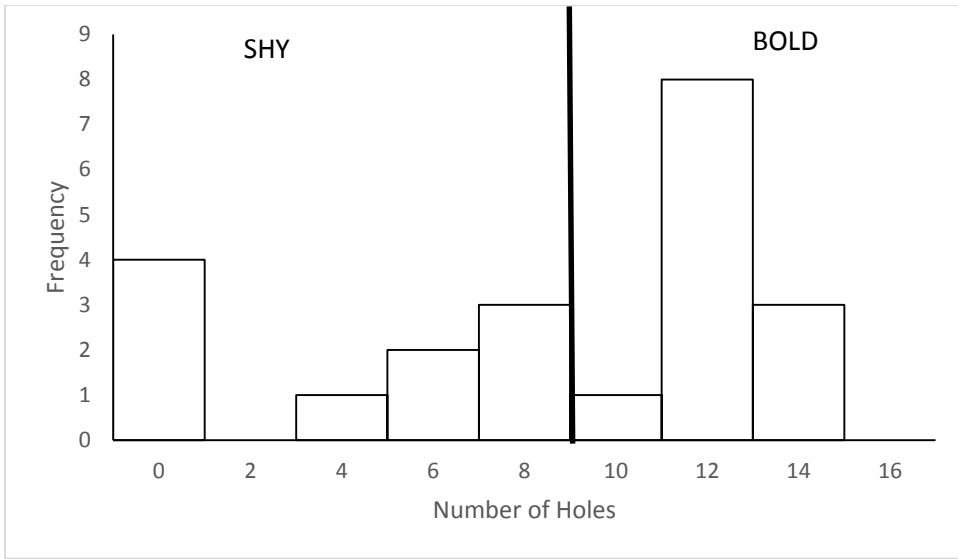


Figure 1.

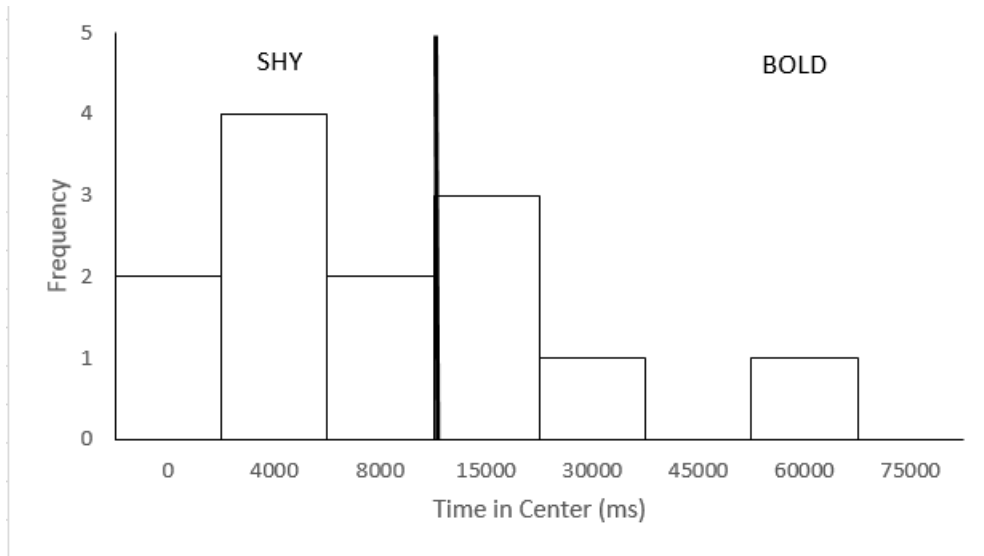


Figure 2.