Mouse Open-Space Behavior

I. Introduction to animal behavior

Ethology is the field of biology that studies animal behavior. You are probably already familiar with many animal behaviors. For example, the "aggressive" behaviors dogs and cats exhibit in response to one another, or the "mating" behavior of a cat in "heat," or the "mobbing" behavior of birds when you get too close to their nests, or the "play" behavior of the squirrels on campus, or the "web-spinning" behavior of a spider, or the "chirping" of crickets on a summer's evening, or the sleep behaviors of your roommate.

Some of the topics in which animal behaviorists are interested include:

- the types of behaviors a particular species can perform,
- the stimuli that trigger behaviors,
- the "purpose" of animal behaviors, and
- the evolutionary origins of the behavior.

Types of behaviors

Have you ever wondered why an animal behaves in some ways that seem similar to human behaviors, yet in other ways that seem "odd," at least to humans? An example of the latter is the behavior of a domestic cat in burying feces in its litter box. After a cat defecates, it uses its paws to spread litter over the feces. Yet, if that cat defecates on the cement floor of a basement (a behavior not to be encouraged), it exhibits the same "burying" behavior, even though there is no litter with which to bury the feces. Why does it do this? Wouldn't such behavior be purposeless in that situation?

This is an example of an **innate behavior**. Innate behaviors result from a stimulus that triggers a **fixed action pattern**, which is a genetically engrained behavioral response. Animals will perform such behaviors automatically when they receive the proper stimulus, whether or not it makes sense (to us). Since these types of behaviors do not require learning they are said to be **instinctive**. Humans also display instinctive behaviors, such as the grasping and suckling behaviors of infants, smiling, crying, and using the voice to communicate, all of which appear to be genetically ingrained.

Humans and animals also display **learned behaviors** due to neurological changes linked to previous experience. Humans have evolved to become more dependent upon these than other animals; thus, for example, we must learn from others how to communicate through a particular spoken language. However, most animals also acquire learned behavior, and these sometimes can be **associative learning**, in which the animal learns to associate particular stimuli and behavioral responses. Any one with a pet cat or dog might observe this when the animals come running every time the refrigerator is opened or the can opener is used. The animals are not born with these behaviors.

What is an ethogram?

An ethogram is a list, with descriptions, of the behaviors that a particular species is capable of performing. Table 1 shows a partial ethogram for the behaviors of blue-gill sunfish as an example. The behaviors have been categorized and named, and each of the behaviors is described in an objective, scientific manner. For example, the phrase "feeding behaviors" actually entails a myriad of separate behaviors, and each specific behavior is give a name. Ethograms are rarely considered complete, since new discoveries about behaviors are constantly being made, and sometimes a scientist might describe only particular types of behavior(s).

Figure 1. Partial ethogram for bluegill sunfish

Locomotory behaviors	
Stationary behavior	The left and right pectoral fins alternate in gentle sculling motions. The pectoral fins are held perpendicular to the body axis and generally oriented in the vertical plane.
Slow forward swimming	Slow forward swimming is initiated by the pectoral fins held in the vertical plane which start from a position perpendicular to the body axis followed by a swift caudal-directed sweep ending when the fins contact the fish's body.
Fast forward swimming	Rapid, broad lateral sweeps of the whole caudal fin and caudal peduncle characterize fast forward swimming.
Feeding behaviors	
Orientation	The body axis is rotated in space toward a food item. Orientation can occur while in stationary behaviour or while in slow or fast forward swim.
Picking	Picking is a rapid biting action at food items located on the substratum, or on structures such as plants and rocks.
Engulfing	Engulfing behaviour is used for the ingestion of both small and large prey items and often follows pursuit of the prey in question using orientation and slow or rapid forward swimming behaviour.
Social behaviors	
Parallel swimming	Two fish engaged in parallel swimming travel in the same direction using slow or fast forward swimming.
Opercular flare	Two fish face each other directly, separated by one to three body lengths. In an opercular flare, there is a lowering of the branchiostegal rays on the mouth floor and a lateral extension of the opercular flaps. In some cases the degree of flaring can exceed 90°.
Tail wagging	A tail wag is an exaggerated lateral undulation of the entire body particularly of the caudal region.

Used with permission from Brian D. Wisenden, Biosciences Department, MSU Moorhead
http://www.mnstate.edu/wisenden/AnimalBehavior/sampleEthogram.doc

Avoiding anthropomorphism

Description of animal behavior must avoid **anthropomorphism**, which is the application of human traits to animals. For example one web page states that "Purring is a sign of love" – yet some cats purr when they are in extreme pain – and some people believe that cats "lovingly" rub their face against their owner's leg; actually the cat is marking the owner with scents from facial glands. We should never simply assume that animal behaviors will reflect human-type emotions. An unexpected stimulus can trigger aggressive behavior in an animal that previously seemed tame, such as when magician Roy Hall was mauled in 2003 by a "trained" tiger.

Animal open space behaviors

When placed in an open space, animals may display different behaviors. Some animals may display an **exploratory behavior**, tending to wander through the area to explore a new environment. Open spaces elicit **fear behavior** in other animals that have an aversion to unfamiliar environments, and these animals will seek dark regions or protective crevices. Other animals may display **wall-seeking behavior (**or "**thigmotaxy**"), a preference to move along the boundary or walls of the space, possibly to sense its dimensions. In contrast, some animals have an **edge avoidance behavior**, such as field butterflies that prefer open sunny areas to the surrounding woodlands. The response to open space may be instinctive, whereas for others it may depend upon the familiarity of the animal with the space.

The objectives of this lab exercise are for you to:

- Become familiar with some of the basic premises and procedures of animal behavior.
- Understand how the scientific method can be applied to studies of animal behavior.
- Improve your understanding of scientific methodology.
- Improve your skills in data presentation and lab writing.

II. Examining open-space behavior of the mouse

A. General procedures

Figure 2. Floor grid designations

A	A	A	A	A	A	A	A
A	B	B	B	B	B	B	A
A	B	C	C	C	C	B	A
A	B	C	D	D	C	B	A
A	B	C	D	D	C	B	A
A	B	C	C	C	C	B	A
A	B	B	B	B	B	B	A
A	A	A	A	A	A	A	A

A = peripheral squares (ps)
B = internal squares (is)
C = central edge squares (ces)
D = central squares (cs)

Organism to be used:

- The domestic mouse, *Mus musculus*

Mouse housing:

- Plastic cages with food, water and bedding
- "Community cage": original location of mice.
- "Reservoir cage": final location of mice.

Experimental "arena":

- Constructed of ¾" plywood
- Cover with brown paper divided into 64, 10cm^2 squares, designated as shown in Figure 2, but letters not actually written – Explain why.
- Cover with sheet of clear Plexiglas.
- Place 5½ inch walls around arena.
- Elevate on a stand 10 inches above a table.

Mouse handling:

- Pick up carefully by tail only.
- Must be quiet during experiment; no loud noises or sudden movements.
- Always introduce mouse into arena at same location.

Group member functions:

- "Mouse handler": introduces and removes mouse from arena.
- "Data recorder": observes position of mouse and records position.
- "Time keeper": starts and ends the experiment; calls out 15 sec intervals.
- "Arena Manager": cleans arena before each replication with lysol; remove any droppings.
- Roles rotated with each experimental replication.

Steps to performing an experiment:

1. Clean arena.
2. Introduce mouse from "community" cage.
3. Record position of mouse every 15 seconds for 6 min.
4. Remove mouse to "reservoir cage".
5. Perform 3 replications for each experiment

Calculations for each experiment:

- Calculate average time spent in each square type.
- Graph averages times.

B. Three experiments

1. Test of the Hypothesis "Mice will prefer to be near walls rather than in open spaces."

Experiment Specific Procedures:

- Same as general procedures.
- Record data in **Table 1** and place averages in **Table 2.**

2. Test of the Hypothesis "Mice will prefer to be near the edges of an area, rather than open spaces."

Experiment Specific Procedures:

- Same as general procedures, except perimeter walls not used.
- Record data in **Table 3** and place averages in **Table 4.**

3. Test of the hypothesis "Mice will prefer to be near walls rather than edges."

Experiment Specific Procedures:

- Using the same experimental apparatus, design an experiment to test this.
- Record data in **Table 5** and place averages in **Table 6.**

IV. Preparing your lab report

1. Lab report will consist only of the Procedures section
2. Read and follow format provided in the Lab Report Guidelines
3. Examine the sample lab report as a model for writing style
4. Evaluation of report will be based upon:
   - Quality of writing; grammar, sentence structure, spelling, etc:
   - Correct formatting of the lab report
   - Proper use of third person passive voice
   - Sufficient inclusion of all procedures
   - Clear description of the procedures
5. Final paper must be submitted to TII.com

V. Data presentation

You should have three sets of data one for each mouse) for each of the three hypotheses tested.

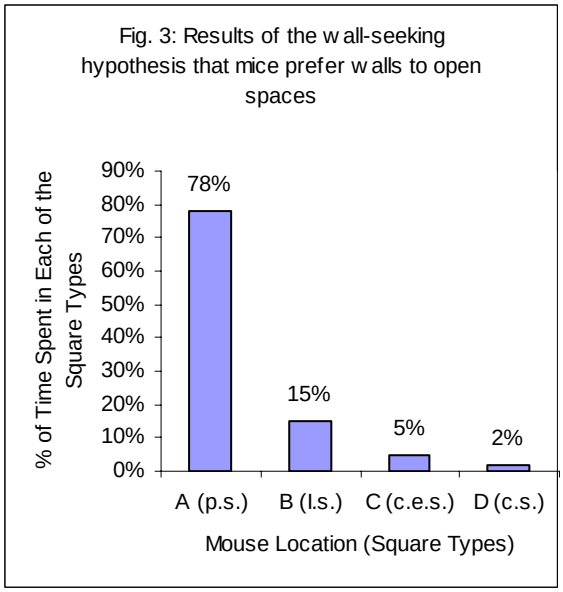
A. Calculations

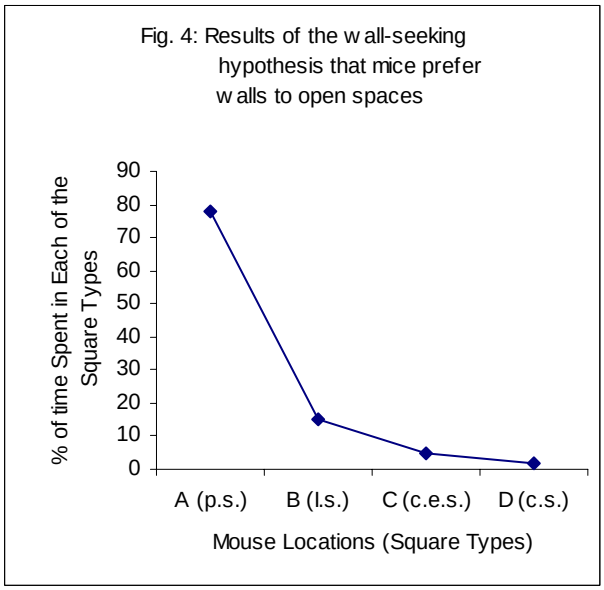
Calculate percent of time in each grid region

% of time in A = (Observations in A) ÷ 24 X 100
% of time in B = (Observations in B) ÷ 24 X 100
% of time in C = (Observations in C) ÷ 24 X 100
% of time in D = (Observations in D) ÷ 24 X 100

B. Graphing the results of the experiments.

Your instructor will discuss which of the following types of graphs is correct.





Key
A = peripheral squares (p.s.)
B = internal squares (i.s.)
C = central edge squares (c.e.s.)
D = central squares (c.s.)

Next week you will learn how to use Excel to graph the data from **Tables 2, 4, & 6.**

Post-lab questions

1. Which type of open-space behavior(s) did the mice display?

2. Do you think the mice are displaying instinctive or learned behaviors? Might the behavior of the mice change if they were left in the arena for an extended period of time?

3. Did all the mice exhibit similar behaviors? Are the results consistent across class groups? If not, why not?

4. Is it possible that different mice might display different open-space behaviors? Explain.

5. The arena is divided into four types of square (A,B, C, D); does each square type cover the same amount of area in the arena. Explain. How might this influence the results?

6. What do you suppose is the adaptive significance of wall-seeking behavior? (It might help you to imagine that while you were asleep last night, someone moved you to a totally dark, very large, completely empty auditorium. When you awaken, what do you suppose you would do first, after you stopped screaming that is? Why?)

Table 1: Raw data from testing whether mice prefer walls or open spaces

(Under each of the 15 sec. intervals for each mouse, record "A, B, C, or D" to represent the square a mouse is in at each interval)

	15 second observation times ---->																							
	0:15	0:30	0:45	1:00	1:15	1:30	1:45	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45	4:00	4:15	4:30	4:45	5:00	5:15	5:30	5:45	6:00
Mouse 1																								
Mouse 2																								
Mouse 3																								

Table 2: % Time spent in each type of square; calculated from the raw data in Table 1

	Square type			
	A	**B**	**C**	**D**
# of observations in each square type				
Percent of total (total ÷ 24 x 100)				

Table 3: Raw data from testing whether mice prefer the edges of an area or open spaces

(Under each of the 15 sec. intervals for each mouse, record "A, B, C, or D" to represent the square a mouse is in at each interval)

	15 second observation times ---->																							
	0:15	0:30	0:45	1:00	1:15	1:30	1:45	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45	4:00	4:15	4:30	4:45	5:00	5:15	5:30	5:45	6:00
Mouse 1																								
Mouse 2																								
Mouse 3																								

Table 4: % Time spent in each type of square; calculated from the raw data in Table 3

	Square type			
	A	**B**	**C**	**D**
# of observations in each square type				
Percent of total (total ÷ 24 x 100)				

Table 5: Raw data from testing whether mice prefer walls or edges.
(Under each of the 15 sec. intervals for each mouse, record "A, B, C, or D" to represent the square a mouse is in at each interval)

	15 second observation times ---->																							
	0:15	0:30	0:45	1:00	1:15	1:30	1:45	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45	4:00	4:15	4:30	4:45	5:00	5:15	5:30	5:45	6:00
Mouse 1																								
Mouse 2																								
Mouse 3																								

Table 6: % Time spent in each type of square;
calculated from the raw data in Table 5

	Square type			
	A	**B**	**C**	**D**
# of observations in each square type				
Percent of total (total ÷ 24 x 100)				

PRE-LAB ASSIGNMENT: **Name _____**

1. What is Ethology?

2. What is an Ethogram?

3. What are two principle types of animal behaviors?

What is a fixed action pattern?

4. Other than the examples given in the lab exercise identify (feel free to consult your text book or search the web):

A. an example of a instinctive human behavior:

B. a learned human behavior:

C. an example of an instinctive animal behavior:

D. a learned animal behavior:

5. What is meant by anthropomorphism?

6. What are 4 different possible responses of animals to open spaces?

1.

2.

3.

4.