Teaching Animal Behavior in Laboratory and Field

an Instructor's Manual to Accompany

Exploring Animal Behavior in Laboratory and Field

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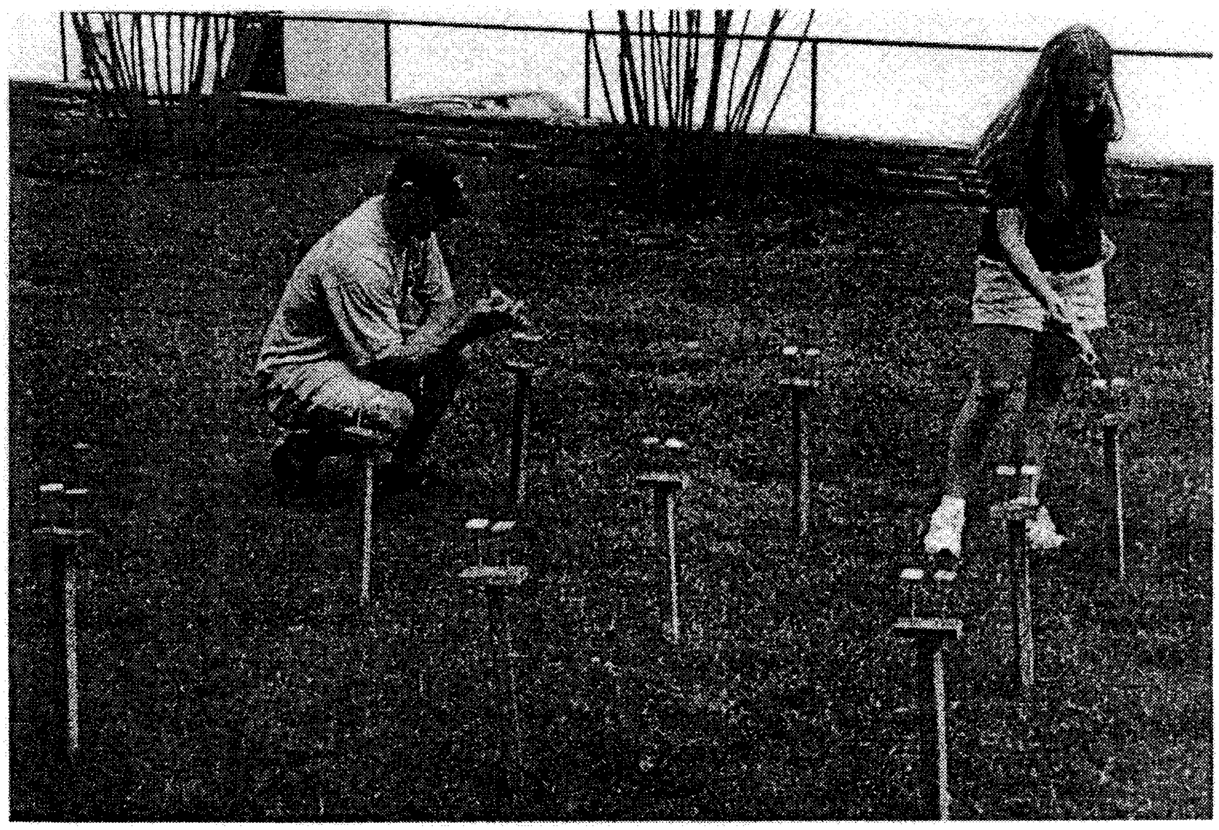

2003

Vigilance and the group-size effect: observing behavior in humans

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LEARNING OBJECTIVES

The objectives of this exercise are 1) to understand vigilant behavior and identify hypotheses for the relationship between vigilance and group size; 2) to look for a group-size effect in foraging humans; 3) if a group-size effect is found, to distinguish and test between pairs of hypotheses to explain this effect in humans; and 4) to learn how to observe humans in a systematic way, using the methods of animal behavior to design experiments, collect and analyze data, present results, and discuss the conclusions.

SUGGESTED TIME-FRAME

We recommend 30–60 minutes for discussion with the students prior to the lab, and approximately 5–6 hours of data collection per exercise (although data for more than one exercise can be collected simultaneously to reduce the time needed). Data collection can be shortened to 1–2 hours per exercise, if you are willing to accept fewer than 30 observations and are not too concerned with potentially ambiguous results due to lower statistical power. Note, however, that it is worth allotting time to collecting pilot data, because it gives students the opportunity to identify and control confounds that they might not have considered initially, as well as to allow high inter-rater reliability to be established. Ideally, 2 regular lab sessions of 3 hours each should be cancelled so that the students can re-allocate this time to 4 1.5 hour observation sessions at lunch or dinner time over a week or so.

LAB GROUP COMPOSITION

Lab groups are described in the procedure. In addition, it is useful to have at least one male and one female student in each lab group, so that the observer is always the same sex as the focal subject.

SUGGESTED PRESENTATION FORMAT

Student Guidelines for a Poster Presentation

Your poster should be neat and professional, fit into a 1.2-meter by 1.2-meter area, and consist of the following sections.

Title.—Poster titles should be brief and convey the general thrust of your research.

Personal information.—State your name and university affiliation (e.g. University of California, Davis). Some of you may have attended poster presentations and seen that presenters sometimes include pictures of their study species. You are welcome, but not required, to include pictures, but ensure that they are from a published source (e.g. magazine) or that you have permission from the person photographed.

Introduction.—Briefly discuss background reading and give citations in the proper format. State your research question. Introduce your hypothesis or hypotheses and predictions.

Methods.—Explain the details of how you collected the data. These details should be relevant to your specific research question. Details should include (but are not limited to) what species you studied and where. Mention any tools you used (e.g. binoculars). Did you identify individuals? If so, how? What sampling methods did you use?

Results.—Present your results clearly and concisely leaving your interpretation of the data for the discussion. Also provide graphical representation (e.g. table, figure, etc.) of the results, which includes a measure of variance (e.g. standard error bars).

Discussion.—State your results in 1–2 sentences. Then interpret your results in the context of the hypothesis or hypotheses you are testing and the background theory and reading introduced earlier. Discuss any limitations of your study.

Summary.—Briefly summarize the research question you addressed, your methods, the data you obtained, and how you interpreted your results in the context of the larger theory and previous research findings.

Acknowledgments.—Use this section to thank individuals or organizations for their help with any part of your study.

References.—List all your citations in the proper format.

HUMAN SUBJECTS GUIDELINES

Research involving human subjects usually needs to be reviewed by the institution's Human Subjects Review Committee or Institutional Review Board (IRB). However, there are certain research activities that are usually exempt from such review, including the observation of public behavior in which subjects are NOT identified. Thus, nonintrusively observing the scanning behavior of subjects eating in public places usually qualifies as one of these exempt research activities. You should verify that this lab meets your IRB's definition of an exempt activity, however, as these definitions may vary across institutions. Finally, it should be emphasized to the students that their observations need to be nonintrusive and that they should never record data that could identify the subjects.

EXPECTATIONS AND SAMPLE ANALYSES

Expected Results

i) Examining the general effect of group size on vigilant behavior

When at least 10 subjects are observed in each of the three conditions, a decrease in scanning frequency and duration are usually observed with increasing group size. In our experience, groups of 1, 2, and 4 work best. We instruct students to use 1-way ANOVAs to analyze their data—appropriate tests because vigilant behavior is compared across 3 conditions, subjects are included in only one condition, and the dependent variable is measured on a ratio scale. If nonparametric analyses are required, the Kruskal-Wallis test for k independent samples can be used. Sample data and analyses for this exercise are provided at the end of this chapter.

ii) Testing between the dilution and many-eyes hypotheses

The amount of conversation is used to test between these hypotheses, because it provides one measure of how occupied the group members are. If the many-eyes hypothesis accounts for the group-size effect, then individuals who are more occupied (i.e. in high conversation groups) will be less able to scan and thus their scanning frequency and duration will be lower than those who are less occupied (i.e. in low conversation groups). Alternatively, if the dilution hypothesis is supported, then how occupied individuals are will not be related to the group-size effect (note, however, that this result is also consistent with the null hypothesis). Most likely, however, the results will be mixed (e.g. there will be a difference in scanning duration, but not in scanning rate).

We instruct students to use independent samples t-tests to analyze their data—appropriate tests because vigilant behavior is compared between 2 conditions, subjects are included in only one condition, and the dependent variable is measured on a ratio scale. If nonparametric analyses are required, the Wilcoxon-rank sum or Mann-Whitney *U* tests for 2 independent samples can be used.

iii) Testing between the predation risk and food competition hypotheses

Comparing groups who share food to those who are not allows us to test between these hypotheses. The food competition hypothesis assumes that individuals who are sharing food will be in competition with one another and need to be vigilant of each other, which will in turn affect each individual's ability to scan the rest of the environment. If this hypothesis is correct, then scanning frequency and duration will be less among subjects in food-sharing groups than in nonsharing groups. Alternatively, we assume that the predation risk hypothesis is not influenced by food-sharing and expect that if it is correct the scanning frequency and duration should not differ between the food-sharing and nonsharing groups (although this result is also consistent with the null hypothesis).

We instruct students to use independent samples *t*-tests to analyze their data—appropriate tests because vigilant behavior is compared between 2 conditions, subjects are included in only one condition, and the dependent variable is measured on a ratio scale. If nonparametric analyses are required, the Wilcoxon-rank sum or Mann-Whitney *U* tests for 2 independent samples can be used.

iv) Testing between the predation risk and conspecific detection hypotheses

The amount of traffic, such as how many people are walking within sight of the focal group or how crowded the eatery is, is a way to test between these hypotheses, because it provides a measure of how many possible conspecifics focal subjects can detect and attend to. The analysis of interactions with passersby will indicate if there is any possibility that scanning is used to detect conspecifics. Alternatively, the predation risk hypothesis is based on the detection of heterospecifics, not conspecifics.

If the conspecific detection hypothesis is correct, then scanning frequency and duration will be greater among subjects in the high traffic area than among those in the low traffic areas, and there will be some interactions with passersby. Would you expect the number of interactions per passersby to differ between the two conditions? Alternatively, if the predation risk hypothesis is correct, then scanning frequency and duration should not differ between the high and low traffic areas (although this result is also consistent with the null hypothesis).

We instruct students to use independent samples *t*-tests to analyze their data—appropriate tests because vigilant behavior is compared between 2 conditions, subjects are included in only one condition, and the dependent variable is measured on a ratio scale. If nonparametric analyses are required, the Wilcoxon-rank sum or Mann-Whitney *U* tests for 2 independent samples can be used.

Choosing Among Exercises ii, iii and iv

In his review paper, Roberts (1996) notes that few studies have attempted to distinguish between the dilution and many-eyes hypotheses to explain the relationship between vigilance and group size. Wawra (1988) provides such a test, but she does not frame it as such and finds mixed results. Thus, if students choose to test between these hypotheses and obtain interesting results, their work may be publishable.

Few studies have attempted to distinguish between the predation, conspecific detection, and food competition hypotheses as well, and to our knowledge these have not been tested in humans. Thus, interesting results from these comparisons may also be publishable.

Possible Confounds and Problems

Possible confounding variables are discussed in the procedure in the Student Instructions. We make a number of recommendations, one of them being that the students observe same-sex, rather than mixed-sex groups. Unfortunately, this reduces the number of observable groups, but data from mixed-sex groups seem to add noise and reduce the size of the effects. You may want to alert students to this, or have them discuss such problems (e.g. see QUESTIONS FOR DISCUSSION). Also, make it clear that only one focal subject is observed per group and that subjects should be chosen randomly.

We urge students to collect pilot data, in order to learn how to do observations nonintrusively. Subjects should never be disturbed or made to feel uncomfortable, even if this means losing observations! Focal subjects may know they are being watched, and thus their behavior may reflect being uncomfortable rather than anything to do with vigilance. You will need to recommend appropriate responses that your students can use if a subject asks why s/he is being watched. We suggest that the students do the following. 1) Apologize for disturbing the person. 2) Explain that they are doing an exercise for class in which they watch people eating and count the number of times the people look up. They should also mention that no identifying information is recorded. Finally, they should also explain that they did not mean to be intrusive or disturb anyone. 3) Drop that trial from the data.

Given the possible confounds and problems, it is important to encourage the students to consider the strengths and weakness of their study. Aside from the difficulties of recording human behavior, and the various factors that need to be controlled (e.g. time of day and week, location, size of group, sex of group and observer), students might discuss what can and cannot be concluded from experiments of this nature.

SUGGESTED STUDENT EXPERIMENTS

Exercises ii–iv serve as follow-up experiments to examine the function of the group-size effect in humans (exercise i). If time is limited, you may opt to have students conduct only exercise i—we sometimes do this in our classes.

SUGGESTED VARIATIONS

Additional variables that can be manipulated or analyzed in any of the exercises are the effects of sex (e.g. Wirtz & Wawra 1986) or age of the focal subjects, group composition, location of observations (e.g. cafeteria vs. romantic restaurant), and time of day (lunch vs. late dinner).

ANSWERS TO QUESTIONS FOR DISCUSSION

If you do not find an effect of group size on vigilant behavior in humans, what implication does this hold for proceeding with exercises ii, iii, and iv?

If the group-size effect is not found, it does not make sense to conduct any of the other exercises. That is, there is no need to examine the function of the group-size effect, if there is no effect.

Are the dilution and many-eyes hypotheses necessarily mutually exclusive? Justify your answer.

These 2 hypotheses are not mutually exclusive. According to both hypotheses, predation risk is the primary selective force for enhanced vigilance with increasing group size, and thus predict that group size will be larger in areas that contain a high density of predators when compared with areas that contain no predators or the incidence of predation is low. The 2 hypotheses differ, however, in that the dilution effect does not depend on the vigilance of the foraging partners, whereas the many-eyes hypothesis does. Both presence of group members and vigilance skills may be important so that both hypotheses could work simultaneously and in unison.

Why did you use only one group size when testing between 1) the dilution and many-eyes hypotheses, 2) the predation risk and food competition hypotheses, and 3) the predation risk and conspecific detection hypotheses?

The use of more than one group size to test these hypotheses introduces a confound (group size) that is not relevant to distinguishing between the hypotheses and would have to be controlled statistically.

What do we assume when we use the amount of conversation as a method of testing between the dilution and many-eyes hypotheses?

We assume that amount of conversation provides one measure of how occupied the group members are, and that individuals in groups with a high amount of conversation will be less able to scan their environment than individuals in groups with a low amount of conversation.

What do we assume when we use sharing vs. not sharing food as a way to test between the predation risk and food competition hypotheses?

We assume that individuals in groups sharing food are experiencing food competition, whereas individuals in groups not sharing food are not experiencing food competition.

What do we assume when we use high vs. low traffic areas as a way to test between the predation risk and conspecific detection hypotheses?

We assume that amount of traffic provides a measure of how many possible conspecifics focal subjects can detect and attend to. Using such a measure also assumes that the predation risk hypothesis is based on the detection of heterospecific, not conspecific, predators.

Why is it important to examine the behavior of individuals in single-sex groups?

By examining single-sex groups, you eliminate one possible influence on behavior—the influence of the presence of potential mates and/or current mates on heterosexual individuals. Requiring single-sex groups adds to the time that it takes to collect data, but it does not impact it that much.

Why should the observer be the same sex as the focal subject?

In our experience, focal subjects detect being watched more often when the observer is of the opposite sex than when of the same sex. Given that it is important to avoid 1) disturbing the subjects as much as possible and 2) influencing behavior because of something the observer is doing, we suggest having students observe subjects of the same sex.

Aside from the hypotheses used in the exercises, what alternative explanation(s) could account for the group-size effect in humans? Might these hypotheses be applicable to other animals?

There are many possibilities, but here are 2 that can lead to some interesting discussion; people may reduce vigilance as group size increases because of 1) increased social interaction (less boredom) or 2) increased opportunity for social display (dominance, intelligence, kindness) in larger groups that could lead to increased reproductive success. The latter could also apply to nonhuman animals.

What further experiments would you conduct to better understand the group-size effect in humans?

There are many different answers to this question. One direction for further study would be to test whether scanning behavior also functions in the context of mating/relationship-related behavior. One could test if there is a sex difference in vigilance, and whether scanning behavior is more common in single-sex than mixed-sex groups. For example, are heterosexual individuals more likely to engage in scanning behavior when in the company of members of the same sex, particularly if they are not already pair-bonded? Is there a sex difference between males and females in this regard?

Interpret your results in an evolutionary framework.

Individuals that engaged in vigilance were more successful at leaving grandchildren, either because they had a higher probability of avoiding predators (many eyes, dilution), were better competitors for a limited food supply (competition for food), or had higher mating success as a result of their higher social status (conspecific detection).

Do you think results obtained in these exercises, with modern humans, reflect the behavior of humans throughout their evolution?

Yes, there is no reason to expect that the general form of vigilance would have been modified due to selection during historic times. Certainly the contexts and specific vigilant behaviors occur in many social contexts now that were fundamentally different from those in even the recent past.

Which of the hypotheses and results do you think are unique to humans?

It is not clear that any would be unique to humans, but the detection of conspecifics is most likely to apply to a smaller number of species that, like humans, have long-term social interaction among specific individuals which is important in mating and reproductive success. As a result, the conspecific detection hypothesis is more likely to apply in humans than, say, in winter foraging flocks of birds.

Which hypotheses and results would you expect to find in nonhuman animals?

The predation risk hypotheses are most likely to apply to small birds and mammals, whereas detection of conspecifics would be most likely to apply in highly social birds and mammals, particularly in nonhuman primates. The competition for food hypothesis is most likely to apply in large foraging groups where food is in short supply, such as in winter foraging flocks of birds.

ACKNOWLEDGMENTS

This lab was originally designed by Montgomerie for his Behavioural Ecology & Sociobiology course at Queen's University in the late 1980s and modified and expanded by Scheib, Cody, and Clayton for their Animal Behavior courses at UC Davis in the late 1990s. All authors contributed to the preparation of this manuscript. We thank D. Owings and L. Miyasoto for their assistance with this lab during the UCD winter 1999 Animal Behavior course. We thank Matthew Campbell, Liza Moscovice, Bonnie Ploger, and Ken Yasukawa for helpful comments on an earlier draft of this paper.

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