Animal Behavior Midterm Study questions, 2017

Challenging questions

1. The following four hypotheses concerning the function of cat purring are proposed in Wikipedia (I've done some editing to shorten the quotation):

A. Purring may have developed as a signaling mechanism between mother cats and nursing kittens. Paul Leyhausen interprets it as a signal that the animal is not posing a threat.

B. Purring, or some purring, seems to be a way for domesticated cats to signal their owners for food.

C. Another theory states that purring triggers a cat's brain to release a hormone that helps it in relaxing and acts as a pain killer. This may be a reason why cats purr when distressed or in labor.

D. A cat's purr can be used as a healing mechanism to offset long periods of rest and sleep that would otherwise contribute to a loss of bone density. The vibrations and contractions of a purr work to improve bone density and promote healing in animal models and humans.

Given the information you have from this class about the evolution of signals:

- Which of these hypotheses propose a signal function (more than one hypothesis could be a signal) for purring and why?
- How would you test each of the four hypotheses? For this part of your answer, give experimental designs.
- Are the hypotheses exclusive, meaning that you have to accept one and reject the others, or could all four explanations be true, and why?
- Thinking critically, do you expect to find an explanation for purring from among these hypotheses or are there other ideas you think should be considered, and why?

2. You observe a group of animals in which some are vigilant (heads-up posture) observing the surroundings, and others are feeding. When a predator approaches, the vigilant animals give alarm calls that alert the other group members. Why might one animal give up feeding and make a signal that might attract a predator to itself? What are the alternative hypotheses and how would you design experiments to test among these hypotheses? (Hint: look at the lab manual chapter on geese and vigilance.)

The figure below (from Kurauwone et al 2013 International Journal of Biodiversity

Article ID 270454) shows time budgets for impala, comparing bachelor herds (males grouped together) with harem herds (one male with several females). Looking at the difference in time budgeted for vigilance between the two types of herds, would you hypothesize that bachelors or harems benefit most from cooperation in vigilance, and why? Where are animals able to put their time if they have to be less vigilant? Is this a surprise? Why or why not—what would you have expected?

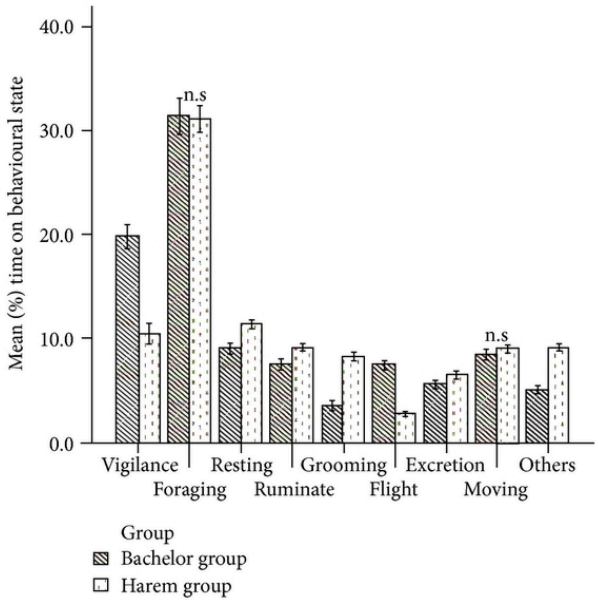


Figure 1: Proportion of time spent on behavioural states by the social groups, (n.s = not significant, $P > 0.05$).

3. The following statement comes from the National Zoo's website:

> "During the summer of 2008, birds were recorded in Washington, D.C. area backyards. Surprisingly, in areas with intense development (e.g. more pavement, buildings and roads), birds sang songs with a lower maximum frequency (the highest pitch of their song gets lower) and a narrower frequency range. Lower-pitched sounds transmit (or travel) better in areas with a lot of hard surfaces and are less likely to be scattered, reverberated (echoed) or absorbed. This result may represent an adjustment birds make for better song transmission in urban environments. However, in areas with higher noise levels (mostly from road traffic), birds sing songs with a higher minimum frequency (they shift the lowest pitch of their songs higher). Noises made by humans tend to be low-pitched, so this result may represent an adjustment birds make to avoid having the low-pitched portions of their songs masked by human noise."

These adjustments in bird song are portrayed as if the birds sense the effects of the environment on their communication and adjust the pitch of their songs depending on

the types of surfaces in their environment and the amount of noise. Using this information, answer these questions:

- Describe at least one proximate explanation and at least one ultimate explanation for the change in birdsong observed in urban environments. What evidence would you need to test each of your possible explanations?
- If birds specialize by habitat depending on the surface and noise characteristics of the available habitats, could this lead to the formation of new species? If so, how would that work?
- Given the importance of signal stereotypy in animal communication, would you predict that the changes in song observed in these populations are going to disrupt mating behavior? Why or why not?

4. According to a study by Hemman et al (2014, Crib-biting and its heritability in Finnhorses *Applied Animal Behaviour Science*. 156:37–43):

> "The cold-blood Finnhorse is a native breed that has been pure-bred since 1907... Stress, lack of enough roughage, gastric discomfort and frustration caused by stall restrictions as well as weaning conditions have been suggested as a causal basis for a horse to initiate crib-biting... A known crib-biting Finnhorse may not be accepted in the studbook, which reduces its value in breeding."

They calculated a heritability for crib-biting in Finnhorses of 0.68. The Y axis in the graph below is the percentage of horses displaying cribbing under the conditions listed on the X axis:

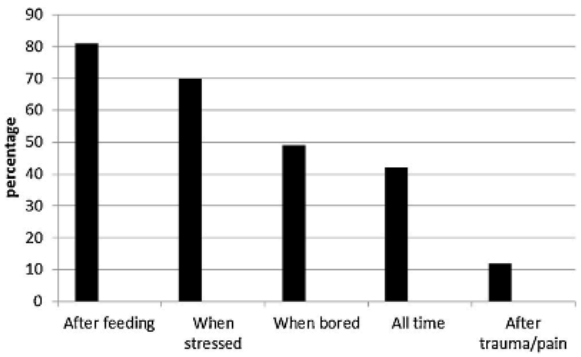


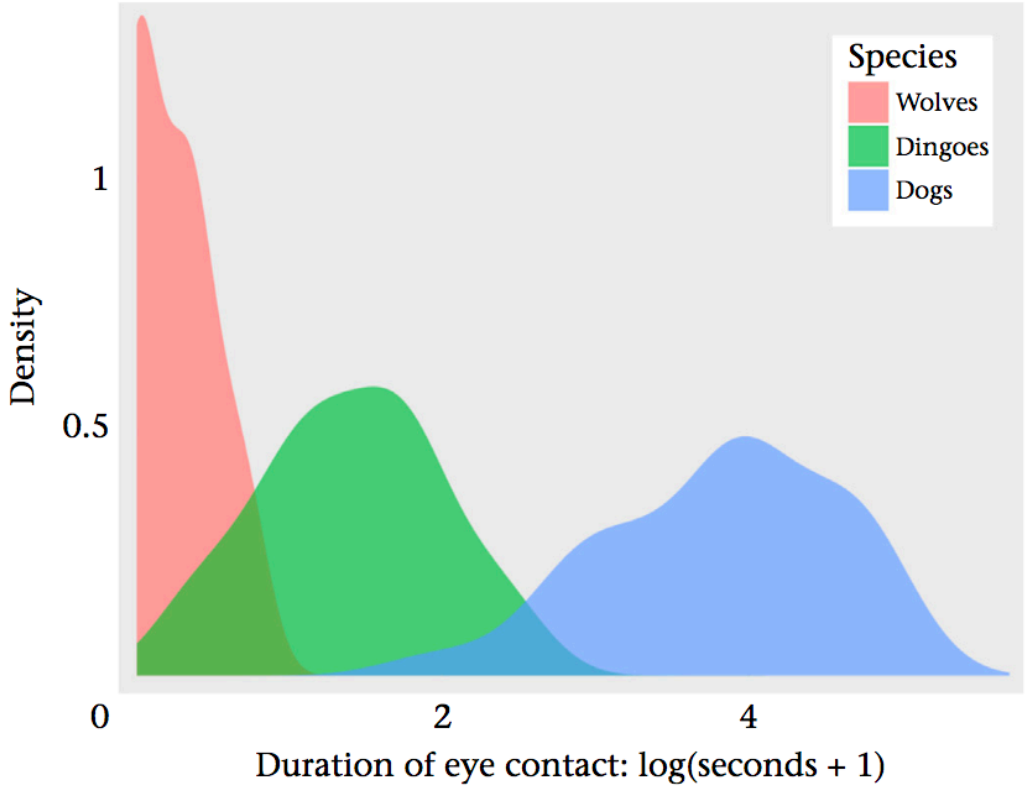
Fig. 1. Questionnaire-based detailed information on crib-biting in Finnhorses. Mean frequencies of different situations in which crib-biting are performed. The figures are based on the observations and descriptions of owners. The total number of horses was 111, of which detailed information of crib-biting behaviour was available from 72 horses (65% of cases).

Based on the data in the above figure from the paper and knowing the heritability of the behavior, write an essay that addresses these questions:

- Could a breeding program be designed to generate Finnhorses with lower likelihood of displaying cribbing behavior?
- Based on the quotation above, why would you guess cribbing is common after feeding? How would you test this?

- How does cribbing in response to stress or boredom (defined by the horse owners “as an extended period of time without company, food or activity”) fit into the general model for pathological behaviors in captive animals that we discussed in class?
- If you were consulting with a horse owner about cribbing, what might you suggest to them to help reduce this behavior?

5. A recent paper by Johnston et al (2017, Uncovering the origins of dog–human eye contact: dingoes establish eye contact more than wolves, but less than dogs, *Animal Behaviour* 133:123-129) presents data on duration of direct eye contact between wolves and humans, dingoes and humans, and dogs and humans. In class we discussed the significance of eye contact in social greetings in wolves and dogs, and we also talked about the related subject gaze following in wolves and dogs. Dingoes are Australian wild dogs; they split evolutionarily from domestic dogs about 5000 years ago and unlike domestic dogs, they have not been subject to artificial selection during that time. In other words, they are intermediate between wolves and domestic dogs. The data in the figure below show that wolves make less eye contact with humans, dingoes are intermediate, and dogs make the most eye contact.



Consider the alternative hypotheses that 1) dogs are wolf-like in their behavior and are culturally adapted (socialized) to fit with human social systems or 2) that artificial selection has shaped dog social behavior to be quite different than that of wolves,

allowing them to fit into human social systems. Does the data in the figure help us to differentiate between the hypotheses? Why or why not?

Think about the status of dingoes as wild intermediates between dogs and wolves. Is there anything puzzling about the level of eye contact made by dingoes? What hypotheses can you form to explain the fact that they make more eye contact that wolves yet are not artificially selected as pets? How would you test your hypotheses?

Somewhat challenging questions

Introduction

1. What are Tinbergen's four questions about animal behavior? Explain each question and why answering the question is useful in understanding behavior.

2. Morgan's canon suggests that we not over-credit animals' capacity to think and feel. What are the advantages and disadvantages of adhering to this advice in the study of animal behavior?

3. What is the Clever Hans effect and why are we concerned about it in the analysis of animal behavior?

4. What is the difference between a proximate and an ultimate cause for behavior? Extend your explanation beyond "here & now" and "past & future" to consider the differences between fitness consequences and mechanism in interpreting a behavior.

Homeostasis

5. What is a time budget and why are these important in the study of animal behavior?

6. Why might measurement of self-directed behaviors be useful in the assessment of animal welfare?

7. What suggestions might be given to zookeepers about designing habitats that reduce the behavioral symptoms of stress in captive animals?

8. What pharmacological intervention might be helpful for a very anxious dog? Why would it be effective?

Genetics

9. The heritability of dominance behavior among males in a species of monkey is high (>80%). Does this observation support a prediction that females use male dominance status in their choice of mates? Why or why not?

10. One of the central issues we've talked about is the ways in which animals balance the use of genetically-based and learned information. Under what circumstances would you predict that selection would favor the use of inherited information? What circumstances favor the use of learned information? Can you develop a general description of the circumstances under which the balance between learned and inherited information might favor one or the other?

11. What techniques can you use to measure the genetic variance of a behavioral trait? Why might it be important to separate additive genetic variance from non-additive genetic variance? If you were making predictions about the effects of selection on a trait, is selection most likely to act on the environmental variance, additive genetic variance, or non-additive genetic variance? For the variance component affected by selection would you expect reduced or increased variance as a result of selection?

12. You measure the heritability of a behavior, and find that it is low (close to zero). What does this tell you about the relationship between genetic and environmental influences on the behavioral phenotype? Is it likely that this behavior has been influenced by strong selection—why or why not?

Learning

13. What are the possible types of play and potential functions of play in an animal's life? How would you test whether a behavior you observe is play or not?

14. A scientist, studying a species of bird, decides to test the hypothesis that song is learned by nestlings of this species. What could be alternative hypotheses to learning for song acquisition? How would you test the learning hypothesis— describe your experimental design, including what a good sample size would be and how the controls need to be designed.

15. What strategies can animals use to find cached food? If you observe an animal shifting the locations of its caches, what might you hypothesize about the behavior of the other animals in the population?

16. Explain the design used in a cross-fostering experiment. What are the treatment and controls? What hypotheses is this experimental design good for testing, and why does it work?

17. Draw a learning curve, labeling the X and Y axis correctly, and give a brief explanation of what a learning curve tells us.

18. An animal returns to a site repeatedly to receive a reward, even though that reward is tasty but nutritionally damaging to the animal. Which neurotransmitter is likely involved in driving this self-destructive behavior and what is the general role of that neurotransmitter in learning?

Cognition

19. In experiments on time-place learning, animals are asked to associate an event that repeats at predictable time intervals with the location that the event occurs. Does the presence of this ability in an animal species suggest that cognition is taking place? Why or why not? What might you look for, in addition to the ability to associate time and place, in order to more firmly establish an argument for cognition?

20. How would you propose to distinguish between a cognitive process and associative learning? In class, we've talked about how difficult if might be to make this distinction.

21. What is mental time travel? Express this concept as a testable hypothesis and design an experiment to test whether dogs can engage in mental time travel. (Be sure you indicate sample size and controls in your experimental design.)

22. What is theory of mind? Express this concept as a testable hypothesis and design an experiment to test whether dogs can engage in theory of mind. (Be sure you indicate sample size and controls in your experimental design.)

Communication

23. What is eavesdropping and why is it an important source of social

information? When might being overheard be costly to a communicating animal? If there is evolutionary pressure to prevent eavesdropping, how might communication be affected?

24. a) What are two things communicated with the waggle dance of a worker honeybee? b) How do the other honeybees receive this information inside a mostly dark hive? c) Which "founding father" of animal behavior first decoded the waggle dance?

25. Males of the great tit (a European bird) sing most in the early morning because the best time to project a signal a long distance is when there is less wind. Can you tell if this is a proximate or an ultimate explanation for the timing of singing in this species? What would be required to know if an explanation for a behavior is proximate or ultimate?

26. What are ritualization and stereotypy? Why are these concepts important in understanding the evolution of communication?

Movement

27. You observe an animal doing a series of loops, then moving in a more or less straight line, and again moving in a series of loops. This pattern is repeated until the animal finds food. What type of search is this and why do animals use the kind of search?

28. We emphasized that mammalian herd migrations usually rely on learned social information, while the distance and direction of bird migrations are usually genetically coded. Analyze the advantages and disadvantages of each way of acquiring information about migratory routes.

29. You are given the task of designing a conservation plan for an endangered migratory bird species. Provide three things you would want to know about the migratory behavior of this species so you can formulate an effective plan. How would you go about discovering what you need to know?

30. Explain the hypothesis for moths flying to lights such as candles or porchlights that was given in class.