

9.20 M.I.T. 2013

Animal Behavior

Lecture #1

- **Organization and procedures**
- **Approaches to the study of behavior**

Animal Behavior: getting started

- Why did you sign up for 9.20?
 - Other than because it can meet a HASS requirement—there are alternatives
 - I can understand if you can give only practical reasons, but tell me some additional ones.
- You could ask me a similar question: Why do I teach this subject?
 - It is fun.
 - We are animals. In studying animals we can learn about our own nature as well.
 - Animals are important for humans in many ways; in basic science, they serve as models—stand-ins for humans. (More about this later.)

Animal Behavior: getting started

- We begin the class at the undergraduate survey level.
- In the second half, we will reach the level of a “special topics” seminar, with student reports during the last group of classes.

Be sure you have access to the course web site.
Check all online documents regularly.

9.20 Organization

1. Organization, requirements

- Quizzes; homework
- Midterm exam
- Report: Written Powerpoint document; oral presentation
- Final exam

2. Key concepts in studies of animal behavior, emphasizing ethology

- Readings from Scott (2005), supplemented by selections from other books, especially from classics in the field (Tinbergen, Lorenz)
- Selected videos

3. Key concepts in sociobiology

- Readings from Alcock (2001), supplemented by selections from other books and some video presentations.
- Key ideas from E.O. Wilson.

4. Student reports

Examples of specific topics

- Habitat selection; nest site selection; territoriality; dispersal; migration.
- Feeding. Foraging or stalking; prey capture; storage/hoarding.
- Antipredator behavior. Detection; tricking the predator; defenses -- individual, social; other adaptations.
- Sexuality. Dimorphisms in body and behavior; social organization, dominance structures; evolution of sexual signals with emancipation from original uses.
- Mating and reproduction. Pair bonding varieties and advantages; brood tending and its evolution; similarities of emancipated actions across widely different species.
- Animal communication and social organization
- Cooperation among conspecifics
- Tool use

Examples of specific questions & concepts

- What is instinctive behavior?
- How is a fixed action pattern organized?
- Why do some animals migrate very long distances every year?
- What is the meaning of sexual selection and natural selection?
- What is the evolutionary origin of kissing?
- Why would an animal behaviorist engage in gene counting?
- What is a “Darwinian puzzle”?
- Why is infanticide common in some animals? Explain how it can be adaptive.
- Why might a worker ant behave differently depending on whether its queen is monogamous or not?

Student reports

- Some but not all student projects will be on topics not covered in class. However:
- Students are expected to interpret the behaviors they study for their reports in terms of principles and concepts discussed in class.

Readings

1. List of books (posted on course website): 2 small textbooks plus books for selected readings; many others we will not have time to read despite their value.
2. Effort expected outside of class: readings, study questions.
 - Posted study questions are often used on quizzes and for homework assignments
 - Try to answer the study Qs prior to class time if possible.
3. Read for key concepts & their illustration in specific examples.
4. Selections from a book by Jim Corbett are posted under session 1 (today's session): These illustrate the knowledge and contributions of amateur naturalists to animal behavior
5. Assignments for next session (posted on course website):
 - Graham Scott ch 1.
 - Chapter 11 from Tinbergen's book *Curious Naturalists*.
 - Study questions on these readings.

Session plan

1. Lecture/discussion of key concepts in readings, usually beginning with the study questions.
2. Some sessions will include viewing of selected videos.
3. Student observations, questions, discussion
4. Final sessions: student reports using Powerpoint slides. Plan: divide class into three parts. Reports will be evaluated by an instructor and by other students.

How have we learned of animals and their behavior?

- Pets, hobbies, encounters in nature and at zoological parks and in films
- Animals in folklore have a long history
 - The “medieval bestiaries”—more imagination than reality, but more accurate knowledge of animals was present in the medieval period according to recent historical studies.
 - Beliefs about rats: See examples in R. Hendrikson, *More Cunning Than Man: A Social History of Rats and Men*, Dorset Press, N.Y., 1983.
 - Examples of how rats have caused people to hate them, and sometimes animals in general
 - Animals have also been blamed falsely for spread of disease: e.g., stories of the bubonic plague (How was plague actually spread?)
 - Not all rodents are hated so much, e.g., hamsters, gerbils

How have we learned of animals and their behavior? (continued)

- ✓ Pets, other personal encounters
- ✓ Folklore
- Human *uses* of animals
 - Meat, leather industries
 - Knowledge of animal behavior has improved the treatment of animals in the slaughterhouses—e.g., the influence and consulting by Temple Grandin
 - Sports; hunting; some religions
 - Uses by scientists (Biology; comparative psychology; pharmacology; toxicology; neuroscience; neuro-engineering)

How have we learned of animals and their behavior?

continued

- Humane society; “animal rights” movement:
Human oriented in a different way
 - Anthropomorphism *re* cognition and feelings
("anthropomentism", "anthropaffectism")
 - Regard for apparent consciousness, in humans and other animals (necessarily subjectively assessed)
- Contrasting attitudes in different religions. The extremes of Judaism/Christianity and Jainism.
- **Basic science approaches in this class:**
 - Both descriptive and experimental,
 - with the perspective of evolution.

Scientific approaches to the study of animal behavior

1. Focus on the individual organism
2. Focus on societies
3. Focus on habitat and the species it supports, and interactions ("balance")
4. Focus on single species or groups of species in a broad way that includes ecology and behavior
5. The amateur "naturalists": The disciplined hobbyist's contributions

Scientific approaches to the study of animal behavior

1. Focus on the individual organism

- a. "Comparative Psychology" in America: *history*
 - The real focus was/is on humans. Learning was the main topic of study, using (mostly) rats and mice as models.
 - This was encouraged by popularity of the ideas of John Dewey (1859-1952) and universal education in America. Emphasis on practicality, and on the shaping of the individual through learning.
 - The idea of the blank slate at birth. The learning theorists and their goals.
 - *Cf. contrasting attitudes in Europe, with a different history.*

Scientific approaches to the study of animal behavior

1. Focus on the individual organism

a. “Comparative psychology” in America

b. Ethology

- **Definition by Konrad Lorenz:** see *The Foundations of Ethology*

p.1: “...it is the discipline which applies to the behavior of animals and humans all those questions asked and those methodologies used as a matter of course in all the other branches of biology since Charles Darwin’s time.”

p. 101: “Ethology, or the comparative study of behavior, is based on the fact that *there are mechanisms of behavior which evolve in phylogeny exactly as organs do, so that the concept of homology can be applied to them as well as to morphological structures.*” (Also see p 3, 65.)

- **Origins in ornithology** [next]

Ethology, continued:

- **Origins in ornithology:**
Whitman and Heinroth (Stories from Lorenz, *ibid.*, p.100, 107)
 - **Charles Otis Whitman** (1898, 1919) kept a collection of doves and pigeons in aviaries.
 - **Oskar Heinroth** (1910, 1928, 1930) studied the rich collection of waterfowl kept at the Berlin Zoo.
 - **They independently discovered that motor patterns, just like morphological characteristics, can be inherited, and can be homologous across different species.**
- *Cf.* **Charles Darwin:** Illustrations from his book

*From Charles Darwin, The Expression of the Emotions in
Man and Animals*

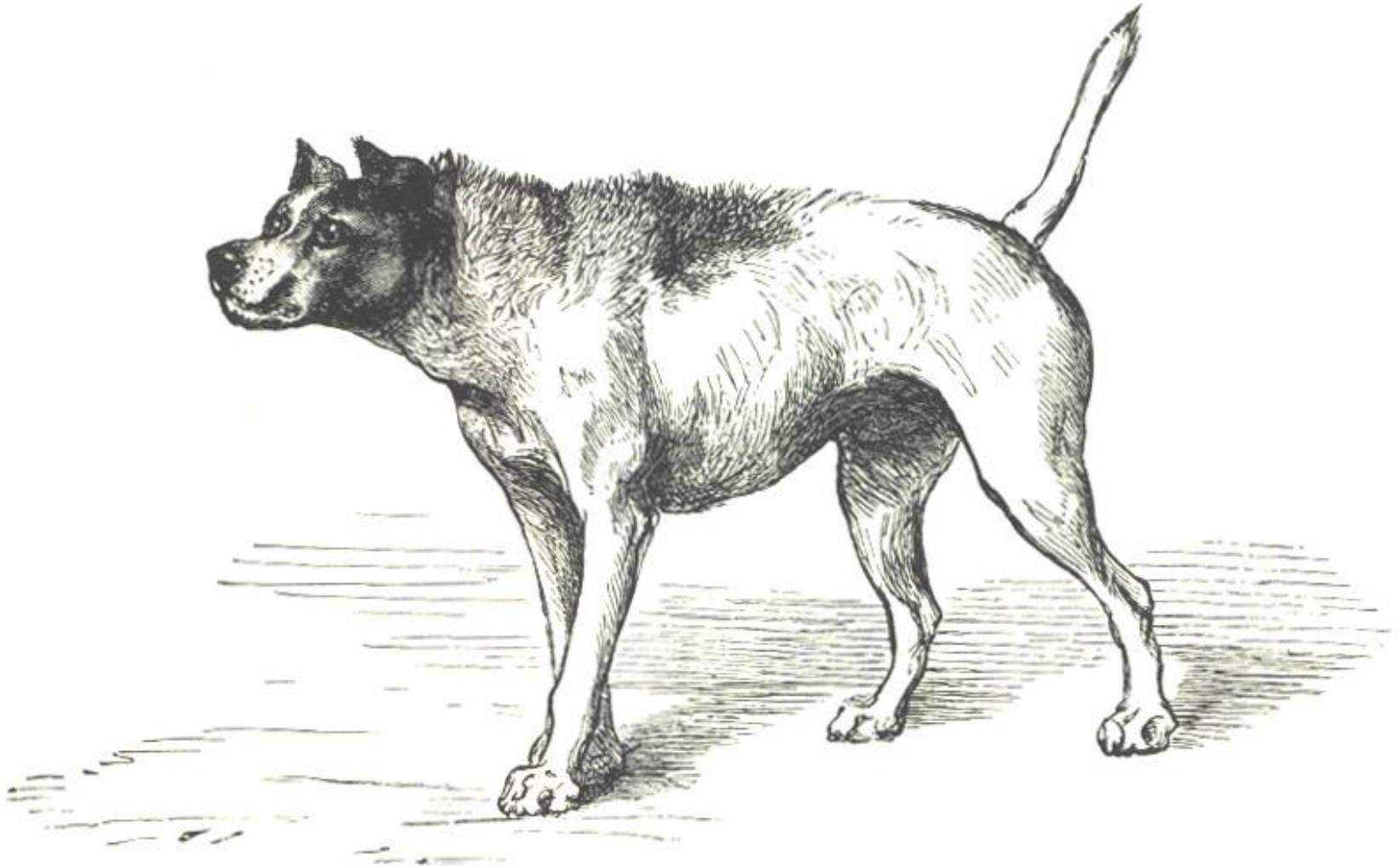


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Dog approaching another dog with hostile intentions (fig 5)

*From Charles Darwin, *The Expression of the Emotions in Man and Animals**

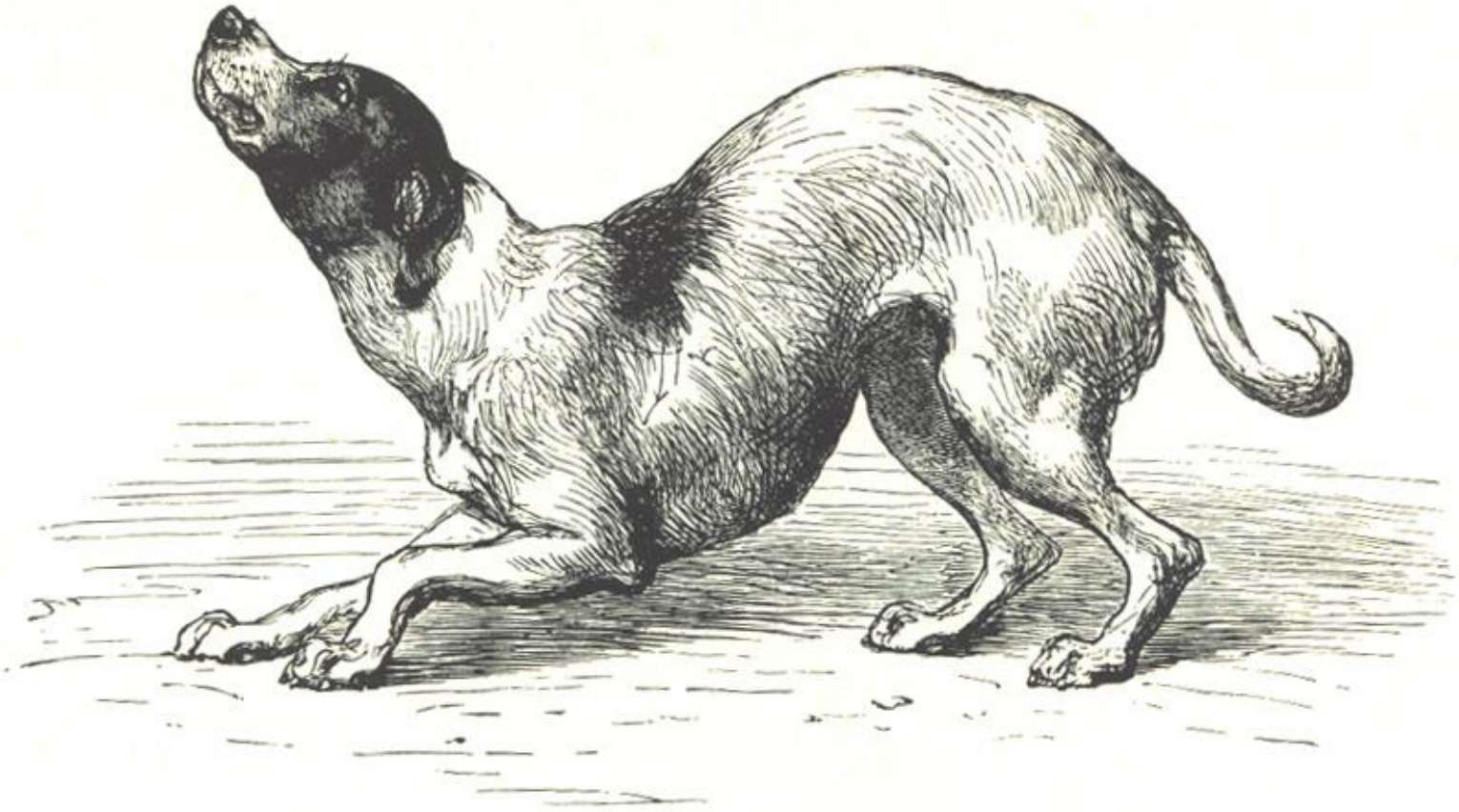


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The same dog in a humble and affectionate frame of mind (fig. 6)

*From Charles Darwin,
The Expression of the
Emotions in Man and
Animals*

The idea of inherited
movement patterns was
applied to human
behavior also.



1



3



2



4



5



Scientific approaches to the study of animal behavior

1. Focus on the individual organism

b. “Ethology”

- Definition by K. Lorenz: see *The Foundations of Ethology*
- Whitman and Heinroth
- Cf. Charles Darwin: Illustrations from his book
- **"Human ethology" of Eibl-Eibesfeldt (book, 1989)**
 - See K.L., pp.10-11
 - Note the popular "body language" craze...
- **"Neuroethology"-- an approach that goes two ways:**
 - Ethology informs brain & behavior studies.
 - Brain manipulation effects provide new info. on behavioral organization.
 - » Examples: multiple kinds of aggression; evidence of primitive vs. advanced behavioral elements (spinal/brainstem vs. forebrain localization).

Scientific approaches to the study of animal behavior

2. Focus on societies

- a. "Sociobiology" (E.O. Wilson, 1975, 1980): study of the biological basis of social behavior in every species. See *Sociobiology, The Abridged Edition*, pp. 3-5.
 - Wilson envisioned the field very broadly, “compounded of roughly equal parts of invertebrate zoology, vertebrate zoology, and population biology.”
 - As an empirical science, it has focused largely on studies of adaptive functions of animal behaviors of all sorts. (Adaptation means promoting gene survival and proliferation.)
- b. *Cf.* sociology and cultural anthropology
 - “Sociology...still stands apart from sociobiology because of its largely structuralist and nongenetic approach.” (E.O. Wilson, *Ibid.*, p.4)

“Behavioral Biology”

*From E. O. Wilson (1975),
Sociobiology (See The Abridged
Edition (1980), p. 4)*

***Concerning Wilson’s prediction:** By 2013, these fields have not diminished much but they have been more integrated with sociobiology. Brain-behavior studies (neuropsychology, cognitive neuroscience) have become more influenced by studies of evolution.

Diagram removed due to copyright restrictions.

Scientific approaches to the study of animal behavior

3. Focus on habitat and the species it supports, and their interactions ("balance")

- a. "Ecology": for example,
 - Tropical rainforest (wet forest) (see *Tropical Nature*, by A. Forsyth and K. Miyata)
 - Other eco-regions: Tropical savannah; temperate rain forest (wet forest); Alaska tundra; warm deserts; cold deserts; etc.
 - Animals are a part of each habitat.
- b. The problem of breadth: Knowing too little about everything.
 - Hence, people often think of ecology as focused on "conservation".
 - But there are good examples of ecology as a science that includes animal behavior: See books on modern "behavioral ecology".
 - When the behavior of animals becomes critical: "Upsetting the balance of nature." Examples: African elephants and the acacia trees. Human hunting, pollution effects, pleasures that encourage poaching, conversion of forests to farmland. Wolf predation in cattle ranches.

Scientific approaches to the study of animal behavior

4. Focus on single species or groups of species in a broad way that includes ecology and behavior

- "Mammalogy" (origins, characteristics, classifications, behavior, ecology)
- "Primateology", "cetology", "entymology", etc.

Example topics from a mammalogy book

(Francois Bourliere, *The Natural History of Mammals*)

- Running speeds of land mammals
- Submersion times of aquatic mammals and amphibians
- Tunnel structures of burrowing mammals
- Composition of milk in various mammals
- Biomass of animals in various habitats

Scientific approaches to the study of animal behavior

5. The amateur "naturalists": The disciplined hobbyist's contributions (*cf.* astronomy)

- Details, when amassed, have been important in the development of ideas about behavioral evolution.
- See Lorenz's comments about the contributions of amateur ornithologists -- bird watchers -- to early ethology: Charles Otis Whitman & Oskar Heinroth
- Jim Corbett's stories (*Jungle Lore*, Oxford Univ. Press, 1953)
 - Examples from the life of a hunter who cared about animals:
Students should read the two selections posted on the web site, under the first class.

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