Lecture Overview

1. What is behavioral ecology?

Behavioral Ecology

1. The study of the evolutionary and ecological basis of behavior.

2. Examines the role of behavior in enabling animals to adapt to their environment.

3. Studies how behaviors impact both survival and reproduction.

4. Called “behavioral ecology” because which behaviors are advantageous depends on the ecology of the animal (food it eats, nesting requirements, its predators).
Behavioral Ecology

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Examples of Questions in Behavioral Ecology

1. Why do animals cooperate?

2. What kinds of traits and behaviors have animals evolved to avoid predators?

3. Why do animals exhibit elaborate mating behaviors?

4. How do animals communicate with each other?

5. What are the genetic, physiological, and neuronal mechanisms that result in behaviors?
History of Behavioral Ecology

• Darwin, 1872 – On the expression of emotions in man and animals

Horror and agony
History of Behavioral Ecology

• Darwin, 1872 – On the expression of emotions in man and animals

• Darwin was concerned with facial expressions, habitual motions, physiogamy (determine character/personality from facial features)
  • inborn relationship
  • acquired relationship

• Questions Darwin asked:
  1. Why do animals tremble in fear?
  2. Why do humans laugh?
  3. Which expressions are for signaling vs. survival function?
Darwin’s Four Sources of behavior

1. To relieve or gratify some underlying mental energy ("nerve force excess").

2. Combination of inherited tendency coupled with habit.

   Ex: Caterpillars that would only eat the plant they were hatched on.

3. Inherent association with other expressions/ actions (more hardwired than #2)

   Ex: Extend arms when falling.

4. Voluntary actions
Lessons from Darwin

1. By classifying behaviors into categories we can assess whether they were inherited and had variation.

2. Many behaviors are variable and inherited. Therefore natural selection will act upon them.

3. Many behaviors are common across different species and therefore provide evidence for common ancestry.
More Darwin

“Hardly any expressive movement is so general as the involuntary erection of the hairs, feathers and other dermal appendages; for it is common throughout three of the great vertebrate classes. These appendages are erected under the excitement of anger or terror; more especially when these emotions are combined, or quickly succeed each other. The action serves to make the animal appear larger and more frightful to its enemies or rivals”
Ethology

1. Old discipline that behavioral ecology grew out of.

2. Ethology = the comparative study of animal behavior.

3. Studies the same behavior across multiple unrelated species to discover the “laws” of behavior.

4. Behaviors can be quantified by constructing an ethogram = a list of the behaviors of a species.
The Nobel Prize in Physiology or Medicine 1973

**Nikolaas Tinbergen (1907-1988)**
- Formally developed Ethology
- Studied the survival value of behavior in black-headed gulls.

**Konrad Lorenz (1903-1989)**
- Studied imprinting (Geese)
- Studied social behaviors
- Wrote “King Solomon’s Ring”

**Karl Von Frisch (1886-1982)**
- Decoded bee language
Tinbergen’s Four Questions for Behavior

1. **Causation**
   - What are the immediate stimuli that produce the behavior?
   - How modified by recent learning?
   - How does behavior function on molecular, physiological, and neurological level?
   - How does the behavior function cognitively and socially?

2. **Development**
   - How does the behavior change with age?
   - What early experiences are required for the behavior to be expressed?
   - How does the environment interact with development and behavior?
Tinbergen’s Four Questions for Behavior

3. **Evolution** (at a Phylogenetic level)
   - How does behavior compare to a similar behavior in a related species?
   - How do phylogenetic processes and constraints affect the behavior?
     - **Ex:** Brain size
   - Why did the behavior evolve the way it did?

4. **Function** (Adaptation at a microevolutionary level)
   - How does the behavior affect an animal’s chances to survive or reproduce?
Niko Tinbergen’s Four Questions

(Mnemonic for Tinbergen’s Questions)
A – Animal
B – Behavior
C – Causation *(Proximate)*
D – Development *(Proximate)*
E – Evolution *(Ultimate)*
F – Function *(Ultimate)*

**Proximate Factors:** What are the *mechanisms* involved?
- Genetics, Developmental biology, Neuroscience, Endocrinology, etc.

**Ultimate Questions:** Why did the behavior *evolve*?
- Evolution and ecology