Animal Behavior

• What is Behavior?
  – “What” an organism does and how it does it

• Why do it?
  – Proximate
  – Ultimate causes

Fish example…

Nature vs. Nurture

• What controls behavior?
  – Nature (genes)
  – Nurture (environment)

• Innate Behavior
  – Why?
  – Automated- too important to leave to chance…

Ethograms

• Ethograms are lists of potential behaviors
  – Quantitative description of an animal's normal behavior

• Basic questions about animal behavior come initially from observations.

A “wolf-to-English dictionary”

Classical Studies

• Ethology- 1930s
  • the scientific and objective study of function and evolution of animal behavior, especially under natural conditions
  – Fixed Action Pattern (FAP)
  • Behavior that is “fixed” and triggered by external stimuli
  • Examples: moths, wasps, sticklebacks, birds

Niko Tinbergen, Konrad Lorenz, and Karl von Frisch- Nobel Prize 1973

Fixed Action Patterns

External Cues…
Niko Tinbergen

The truck…
Gulls
Frogs

Behavioral Ecology

• Behavior as an evolutionary adaptation
  – Natural selection will favor behaviors which enhance survival and reproduction (fitness)

Optimal Behavior Theory
  – Cost-Benefit analysis
  – How high? What size? How long?

http://www-rohan.sdsu.edu/~jmahaffy/courses/f00/math122/lectures/optimization/opt.html
Learning- Imprinting
Konrad Lorenz
- Learning limited to a specific time period
  - Generally irreversible
    - Critical Period
      - Not only when young
      - Young, Parents, Identity, language

Fixed Action Patterns-
- Egg rolling; imprinting, super stimulus

Learning
- Experience-based modification of behavior
  - Can modify innate behaviors
  - Vervet Monkeys- 3 calls- Snake, Eagle, Leopard...
  - Learning vs. Maturation
  - Habituation
    - Simple learning- loss of responsivenes
    - "Cry Wolf"
    - Why?
  - Dishabituation

Associative Learning
- Classical Conditioning
  - Linking one arbitrary stimulus with another
    - Pavlov’s dogs- 1920s- meat, bell, salivation- what about you?
- Operant Conditioning- rewards/punishment
  - Trial-and-error
    - B. F. Skinner’s Box
    - Rat maze

Play
- No apparent external goal, but mimics goal-directed behaviors (i.e. play fighting)
- Not without risk ("all fun and games until...", "You’ll shoot your eye out!")
- Cost, energy, risk, etc. so why do it?
  - Practice Hypothesis- fight, hunt, reproduction (those warm and fuzzies)
  - Exercise Hypothesis- use muscles needed in adult activity
  - Raskoff’s Hypothesis...

Simple cognitive mechanisms
- Kinesis and Taxis
  - Kinesis- random change in activity, or direction in response to a stimulus
    - Photo, Rheo, Chemo, ...
  - Taxis- automatic directed movement towards or away from a stimulus
    - Pill bugs, coral larvae, fish in current
Simple cognitive mechanisms

- **Landmarks**
  - Niko’s wasps, bees

- **Migrations**
  - Birds, whales, butterflies, tuna

Migrations

- **Elephant Seals**

Cognition

- Ability to perceive, store, process, and use information
- Problem solving behavior is highly developed
  - Primates, whales, birds, octopuses, others...

Is this what we mean by intelligence?

Reasoning

- **Insight learning** = The ability of animals to perform appropriate behaviors on the first attempt in situations with which they have no prior experience.
- Insight learning is best developed in primates.

Intraspecies Competition

- When do you draw the line between the ind. And the pop.?
- Limited resources
  - Space, food, mates...
- Can be cooperating and still competing for resources
- Agonistic - Threatening behavior
  - Often "ritual": What is it worth?

Reconciliation

Competition cont.

- **Dominance Hierarchies**
  - "pecking order"
  - Alpha, beta, gamma...
  - Birds, seastars, canines, felines, primates...
- **Territoriality**
  - Defended area for feeding, mating, etc.
  - Territory vs. home range.
Mating behavior

- Courtship
  - Behavior that leads up to copulation
  - What is the purpose of courtship?
- Sexual Selection
  - Different amount of Parental investment
  - Who is the choosy one?
  - What do you find "sexy"?
  - What are you really looking at?

Mating systems

- Promiscuity vs. Monogamy
- Polygamy
  - Polyandry: One female, many males
  - Polygyny: One male, many females
- Factors influencing mating systems
  - Needs of young: when two are better than one
  - Parental certainty
  - Internal Fert. vs. External Fert...
    - which might have more care?

How do animals communicate?

- Communication: transmutation, reception, and response to signals
- What signals?
  - Visual, auditory, chemical, tactile, electrical signals-
    - They are all habitat/lifestyle dependent
  - Pheromones: chemical signals specialized for communication

The Waggle Dance

- Karl von Frisch

The “Altruistic dilemma”

- Selfishness reigns in biology: Maximizing your reproductive success is the name of the game (fitness)
- So, why can we find altruism?
  - Bees (Evolved over 12 times in Hymenoptera)
  - Ground Squirrels
  - Mole Rats
  - Altruism: reduce your fitness and increase another’s

Hamilton’s Rule

- How can this be an evolutionarily stable strategy?
  - Parental sacrifice
  - Sibling sacrifice
- Inclusive fitness
  - Total effect an individual has on proliferating its genes: both with own offspring and with aid to related individuals
  - It’s all about the genes
- William Hamilton
  - Proposed quantitative measure for predicting altruistic acts
  - Selection favors altruism if:
    - \( rB > C \)
    - Examples: Brother on the cliff, Cousin on the cliff...
      - Each will save two kids...
      - “I would lay down my life for two bothers, or eight cousins”: Haldane
Kin Selection

• Kin Selection
  – Inclusive Fitness…
  – Natural selection that favors altruism to enhance genetic success of related individuals.
  – Kin Selection weakens the further related
    • Cousin share r = 0.125. Does it pay?
• What about our bees, squirrels and mole rats?
  – For example, in bees: sisters are more related to each other (r=0.75) than they are to their mother (r=0.5)…
• Reciprocal altruism- non-related “altruism”

Core Ideas- Behavior

• Nature vs. Nurture- genetics and environment
  – Innate behaviors; fixed action patterns
• Evolutionary link to behaviors- who is calling the shots?
  – Optimal foraging theory, etc.
• Learning- how do we modify and alter behaviors
  – Imprinting; habituation; Associative learning; Play
  – Cognition; reasoning, and responses
• Species interactions- behaviors with others
  – Competition; mating; communication; cooperation and kin selection