Early Work

- Konrad Lorenz and Niko Tinbergen described the basic concepts in animal behavior.
- What appears to be rational retrieval of an egg by a goose can be a fixed pattern behavior.
- Such predictable sequences are called stereotypical behaviors.
- Lorenz labeled any stimulus that triggered a certain innate behavior as a releaser.

Behavior

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Behavioral ecology

- Focuses on individual behavior that maximizes reproductive and evolutionary success and studies mate choice, foraging, parental investment, etc.
- Much of the work by comparative psychologists and ethologists can be found under the discipline of behavioral ecology.

Ethology

- Study of animal behavior as a science had its roots in the 1872 work of Charles Darwin.
- Ethology is the scientific study of animal behavior in its natural habitat.
- A central theme of ethology is behavioral traits, which can be isolated and measured, and they have evolutionary histories.
- Sociobiology focuses on the study of social behavior and is represented by four "pinnacles":
  - Colonial invertebrates, such as the Portuguese man-o’-war, are tightly knit composites of interdependent individual organisms.
  - Social insects such as ants, bees and termites have developed sophisticated systems of communication.
  - Dolphins, elephants and some primates have highly developed social systems.
  - Humans have a unique social behavior.
Innate Behavior

- Invariable, predictable, stereotyped behaviors are inherited or innate.
- Instinctive behaviors are dependent on interactions between an organism and its environment.
- The behavior is independent of learning.
- Programmed behavior is controlled by the nervous system and is not learned.
- More complex animals with longer lives have more time for social interactions and learning.

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are inherited or invariable, predictable, stereotyped behaviors.

Most inherited behaviors do not show simple segregation, but show an intermediate behavior.

Cross-breeding of lovebirds that carried nest material either in the beak or in the feathers produced hybrids that exhibited a confused carrying behavior.

Honeybee Hygiene

Honeybee hygiene is learned. The behavior is not simple, but shows an intermediate behavior.

Two components of the behavior: removal of cell caps and removal of infected larvae.

American foulbrood is susceptible to a bacterial disease called "Hygienic" removal of cell caps and removal of infected larvae.

Hygienic "hygienic" bees, uncap cells and remove rotten larva.

Genetics of Behavior

- Hereditary transmission of most innate behaviors is complex with many interacting genes.
- However, some behavioral differences within species show simple Mendelian transmission.
- Honeybee Hygiene is susceptible to a bacterial disease called American foulbrood.
- Removal of dead larvae from hive reduces chance of spreading infection.
- "Hygienic" bees, uncap cells and remove rotten larva.

Two components of the behavior: removal of cell caps and removal of larvae.
Learning and the Diversity of Behavior

- Repeated stimulations diminished release of neurotransmitters from sensory neurons
- Sensory neurons continued to fire, but with less neurotransmitter the system was less responsive
- Sensitization involved action of a facilitating neurotransmitter that was stimulated by the noxious agent and increased the amount of transmitter released by the siphon sensory neurons
- More complex kinds of learning may involve formation of new neural pathways and connections as well as changes in existing circuits

Learning and the Diversity of Behavior

- **Imprinting**
  - Imposes a stable behavior in a young animal by exposure to particular stimuli during a critical period in development
  - A newly hatched or duckling follows its mother
  - If isolated, it follows the first large object it sees
  - Konrad Lorenz hand-reared goslings and they imprinted on him
  - There is only a brief sensitive period when imprinting can occur
  - The bond then lasts for life

Learning and the Diversity of Behavior

- **Bird Songs Learned During a “Critical Window”**
  - Songbirds demonstrate robust sex differences in many aspects of behavior
  - Songs of sparrows are important territorial calls and rely partially on learning
  - If a baby bird is reared in isolation, it sings a rudimentary song
  - The sparrow must hear a normal bird song in a critical period 10–50 days after hatching
  - The young sparrow does not learn the songs of other species of birds during this time

Learning and the Diversity of Behavior

- **Social Behavior**
  - Any response of one animal to another animal of the same species is a social behavior
  - Two rival males fighting for possession of a female is a social interaction
  - Moths swarming around a light, or trout in a cold portion of a stream are not exhibiting social behaviors
  - Simply individuals responding to an environmental cue
  - Social aggregations depend upon signals from the animals themselves
  - Among some animals, breeding may be the only adult social behavior
  - Other animals form strong monogamous relationships for life
  - Mother mammals and birds often form social bonds with their young until they are fledged or weaned
Selective Consequences of Sociality

- Social aggregations provide both passive and active defense.
- Organisms are safer in a group than they are alone.
- In a breeding colony of gulls, an alarm call brings many to attack the predator en masse.
- Prairie dogs live in a loose group and benefit from the extra eyes, ears, and noses of others for warning.
- The more animals there are in a group, the less likely an individual within the group will be eaten.

Antagonistic or Competitive Behavior

- Aggression is an offensive physical action, or threat, to force others to abandon something.
- Agonistic behaviors are a broader category including any activity related to fighting.
- Animals reserve their dangerous weapons for securing prey and do not use them on their own species.
- Animal aggression within a species involves symbolic or ritualized displays that avoid injury or death.

Social Behavior

- Disadvantages of social living
  - Camouflaged individuals survive predators by being dispersed.
  - Large predators need large amounts of food.
  - The ecological situation determines if a solitary or social strategy is better.

In socially coordinated behavior

- Individual adjusts its actions to presence of others to increase its own reproductive success directly.

In cooperative behavior

- Individual performs activities that benefit others because such behavior ultimately benefits the individual's genetic contribution to future generations.

Transfer of Innovative Behaviors

- A female's Imo, acquisition of food-cleaning skills soon became common in the group.
- Illustrates that the social setting provides opportunities for acquisition and sharing of complex learned behaviors.

Social Organization Benefits

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  - Individual performs activities that benefit others because such behavior ultimately benefits the individual's genetic contribution to future generations.

Social Aggression

- A ritualized display is a behavior that has been modified through evolution to make it effective in serving a communicative function.
- A wide array of animal "fights" involve ritual jousts: fiddler crab claw battles, male rattlesnake dances, puffing fish, giraffe "necking," and bighorn sheep butting heads.
- The loser of a ritualized battle often runs away or signals defeat by a subordination ritual.
Altruism and Kin Selection

- If animals behave selfishly to produce as many offspring as possible, then why do some animals help others at risk to themselves?
- Some cooperative behavior may be explained easily
- Other forms of cooperative behaviors seem to require additional explanation
- Until the mid-1960s, it was difficult to explain altruistic behaviors

Social Behavior

- The victor in such competition has access to the contested food, mates, or territory
- Schjelderup-Ebbe first described the dominance hierarchy of chickens from the pecking order that the animal established in a barnyard
- Weaker members may die in times of food shortage, etc.

Territoriality

- Territory
  - Fixed area whose occupant exclude intruders of the same species and sometimes other species
  - Territorial defense occurs in insects, crustaceans, fishes, amphibians, lizards, birds, and mammals
  - Territoriality may be an alternative to dominance behavior
  - High cost of maintaining the territory boundaries may outweigh the benefits

Social Behavior

- Most energy may be expended in establishing a territory
  - Once established, it may be easy to defend
- Male songbirds establish territories; the population remains stable as young assume the parent’s role
- Sea birds may establish a territory in a colony that is barely the size of one nest site
- Mammals have home ranges rather than territories, and ranges may overlap
- A baboon troop may switch ranges to obtain better resources

Mating Systems

- Behavioral ecologists classify mating systems by the extent males and females associate during mating
- Monogamy is an association between one male and one female at a time
- Polygamy is a term that incorporates all male and female systems with more than one mate
  - Polygyny indicates that a male mates with more than one female
  - Polyandry indicates that a female mates with more than one male

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Kin Selection

- In 1964, William Hamilton proposed a theory of kin selection.
- Fitness is not just measured by an animal’s own offspring, but the increase or decrease in genes shared in the gene pool.
- Alleles are shared closely with parents and siblings.
- Inclusive fitness is the relative number of an individual’s alleles that are passed on to future generations from one’s own offspring or that of related individuals.

Animal Communication

Signals

- Through communication, one animal can influence the behavior of another.
- Animals are limited to communication using sounds, scents, touch, pheromones, and movement.
- In contrast to learned and highly variable human language, animal communication is by signals.
- Each signal conveys one message and cannot be rearranged to construct new kinds of information.
- The song of a cricket signals the species, sex, location, and social status of the sender.
- The cricket cannot alter his song to provide additional information.

Communication by Displays

- A display is a behavior that serves a communicative purpose.
- Moth pheromones, bee dances, gull alarm calls, and courtship dances are all displays.